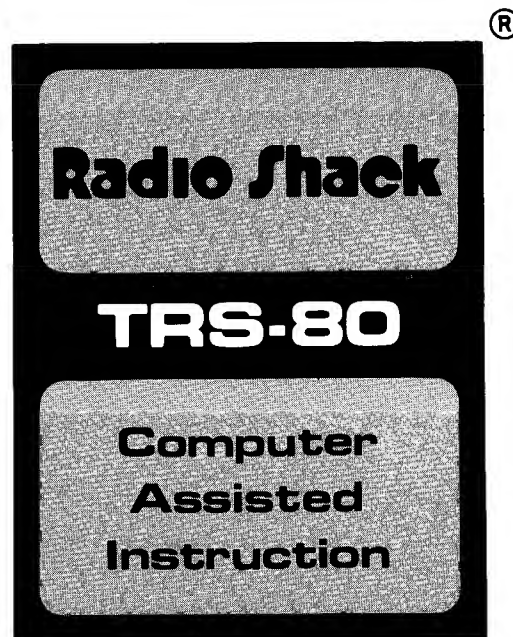


Essential Math Program, Volume Two

Catalog Number 26-1719



The Radio Shack® Essential Math Program is designed specifically for use in a classroom environment as a supplement to regular instruction. It can serve as a valuable aid in drilling students on new concepts as they are introduced to the class. Volume Two of this program includes skill building exercises, a placement mode, and lesson content summaries for fractions, decimals and percent, and pre-algebra concepts for grades 7 through 12.

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Radio Shack® Essential Math Program
Volume Two

Radio Shack®



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FORT WORTH, TEXAS 76102

First Edition

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FOREWORD

The Radio Shack Essential Math Program, Volume Two, is designed to help students master the mathematical skills which are essential for survival in today's world. It is a self-paced drill and practice program in Fractions, Decimals and Percent, and Pre-Algebra concepts for grades seven through twelve.

The Essential Math Program aids the learning process by reinforcing concepts originally introduced and explained by the teacher. This approach can have tremendous advantages for both teacher and student. The teacher is freed from the task of personally supervising drill and practice sessions for an entire class of learners, making it possible for him or her to give personal attention where it is most needed. The student, in using the computer for such sessions, has his or her own private "tutor" to give constant feedback on problems as they are worked. In this way, instruction is personalized and more efficient use is made of the available classroom time.

We believe that you will find the Radio Shack Essential Math Program effective in equipping your students with the mathematical skills they need to cope with the increasingly complex demands of life.



Professor of Educational Administration,
The University of Texas

Former Associate U.S. Commissioner
of Elementary and Secondary Education

Former Superintendent,
Dallas Independent School District

Consultant,
Radio Shack

PREFACE

The Radio Shack Essential Math Program, Volume Two, is intended to supplement regular classroom secondary mathematics instruction by providing intensive practice on new concepts after they have been presented by the teacher. The recommended procedure is that the students take one practice session at the computer each day. Because this microcomputer-based practice is intensive, sessions should probably be limited to a maximum of fifteen to twenty minutes to avoid the possibility of fatigue. The student benefits most from the program when *short* sessions are taken on a *daily* basis.

The Radio Shack Essential Math Program is ideally suited for use with the Radio Shack Network Controller, which allows the teacher to load a program into a central disk-based TRS-80 Model III or Model I, and then send the program through the network to as many as 16 cassette-based TRS-80s simultaneously. This provides a quick and convenient means of loading programs into individual student stations. The Radio Shack Essential Math Program is also designed for use with the following stand-alone TRS-80 systems:






- TRS-80 Model III (with Model III BASIC) 16K tape system
- TRS-80 Model III (with Model III BASIC) 32K or 48K disk system
- TRS-80 Model I (with Level II BASIC) 16K tape system
- TRS-80 Model I (with Level II BASIC) 32K or 48K disk system

The following is a partial list of the features of the Essential Math Program, Volume Two:

- The placement mode can be used to move a student rapidly through the lesson sequence until he or she reaches an appropriate level of challenge. At that point, regular lessons begin.
- The optional promotion/demotion feature evaluates the student's score on a lesson and recommends the next lesson based on the student's performance. If the student opts to take another lesson at that point, the computer will automatically send the student to the recommended lesson.
- Reinforcement messages keyed to correct and incorrect answers appear on the screen as the student works through a lesson.
- The time-out feature displays a prompting "**TIME**" message on the screen if the student doesn't respond to a problem after a pre-determined number of seconds.
- The teacher can set up a student session to present a specific number of problems and terminate automatically, or can end a session after a time limit. This allows for maximum flexibility in a classroom or learning lab.
- Instruction is individualized. Each student moves at his or her own pace. The student is constantly challenged, but never threatened.
- A self-pacing feature gives the student limited control over the rate at which new problems are presented.

- Problems are generated randomly according to specific rules for each lesson. This means that no two repetitions of a lesson will be exactly alike.
- Lesson content summaries are included in the manual to aid the teacher in coordinating lessons from the Essential Math Program, Volume Two, with regular classroom instruction.
- Comprehensive reports are provided. At the end of each student session the screen displays the total number of problems attempted, the number correct, the percentage correct, and (if the promotion/demotion feature is used) the next recommended lesson.
- Student Record Sheet forms are included in this manual to help the teacher keep a detailed and accurate report of each student's progress.

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ORGANIZATION OF THE PROGRAM

ORGANIZATION OF THE PROGRAM

The Radio Shack Essential Math Program, Volume Two, is a series of ten instructional computer programs written in BASIC for use with the TRS-80 microcomputer. These ten computer programs make up three complete lesson sequences with three programs included for Fractions, four programs for Decimals and Percent, and three programs for Pre-Algebra concepts. Individual lessons within each sequence are numbered from R1 to R5 (review lessons) and from 65 to 90 (regular lessons).

This manual is divided into the following sections:

Section II, **HOW TO USE THE PROGRAM**, gives a step-by-step description of how you can put the Essential Math Program, Volume Two, to work immediately for your students. At the end of this section are sample Student Record Sheets which you can copy for use with each student.

Section III, **MORE INFORMATION ABOUT THE PROGRAM**, is a detailed reference section which describes the special features available and gives suggestions for using the programs effectively.

APPENDIX I, LESSON CONTENT SUMMARIES, summarizes the kinds of problems you'll find in each lesson to help you quickly select the lessons you need.

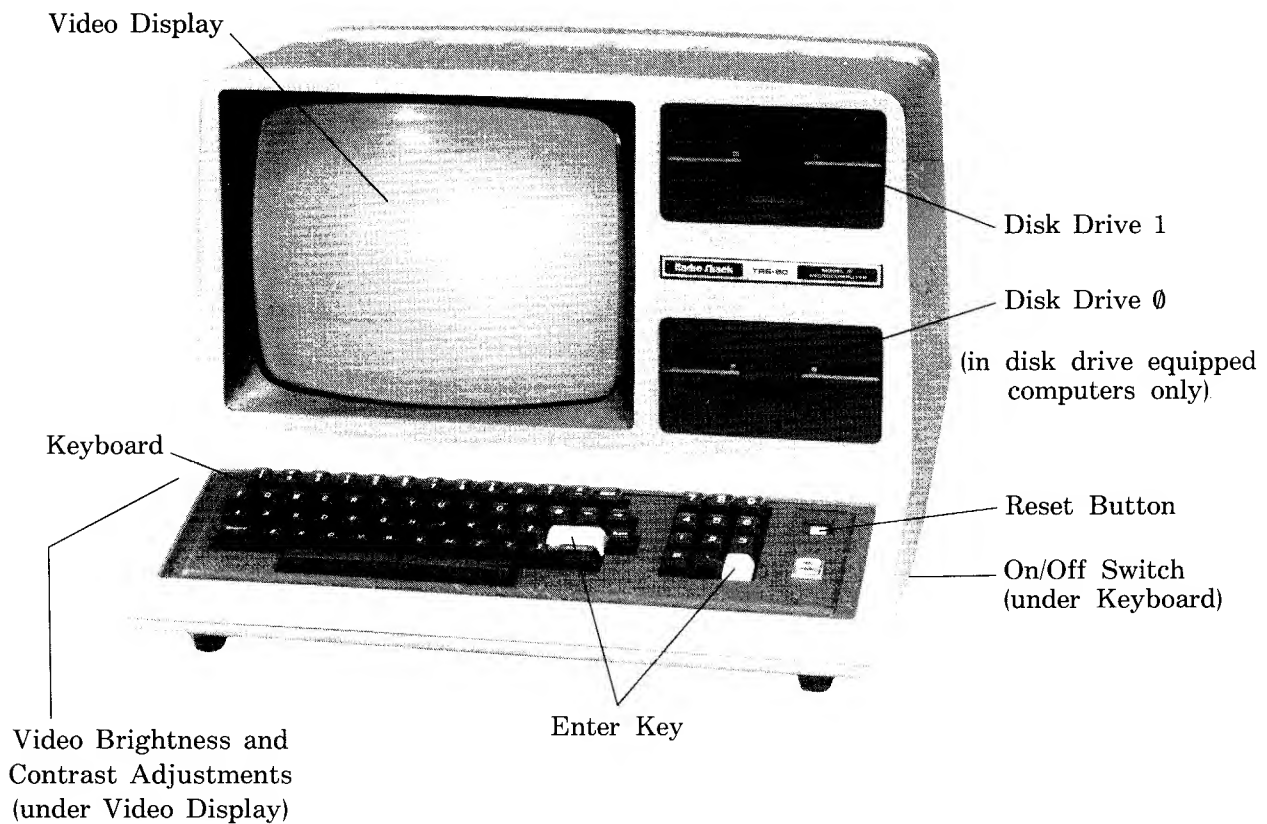
APPENDIX II, PLANNING YOUR APPLICATION, provides helpful information on installing and operating your equipment, to help you obtain the most satisfaction from the TRS-80 in your school setting.

APPENDIX III, MAKING A BACKUP COPY OF THE ESSENTIAL MATH PROGRAM, tells how you can make a working backup copy of program tapes and diskettes so that you may store the original and protect it from damage.

HOW TO USE THE PROGRAM

THE TRS-80 COMPUTER

Before loading an Essential Math program into the TRS-80, take a moment to familiarize yourself with the computer. Here are the major components you'll need to know:



Note: If you are setting up your TRS-80 for the first time, refer to the user's manual packed with each TRS-80 system for instructions.

Before you load your program, let's take a moment to review some special keys and features.

SPECIAL KEYS AND FEATURES

Keys and Features

Function

■

This flashing square is called a "cursor." When the cursor appears on the screen, it is your turn to enter information into the computer. You will see the cursor after questions such as "**DO YOU WANT THE PLACEMENT MODE (Y/N)?**■". (The cursor does not appear after all questions; however, it is always necessary to type in a response when a question appears on the screen.) Note: On the TRS-80 Model I, the cursor is a short line rather than a flashing square.

READY

> ■

The "READY prompt" appears on the screen whenever the computer is waiting for a command (for example, **R U N " F R A C T 1 "** **ENTER**).

ENTER

This key is used to enter information into the computer. Remember to press **ENTER** after you have:

- typed in your name
- typed in a lesson number
- typed **R U N** or typed **R U N** followed by a filename in quotation marks.
- typed answers to questions the computer asks when you are setting up a lesson.

Y/N

Type **Y** for YES, or **N** for NO. This is done when the following questions appear on the screen:

- **ANOTHER LESSON NOW (Y/N)?**
- **DO YOU WANT THE PLACEMENT MODE (Y/N)?**
- **DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?**


SHIFT S

Whenever you want to stop the lesson and get a student report (for example, at the end of a timed session), hold down the **SHIFT** key and press **S**. This code is also used to send the student directly to his first lesson after the placement process has been completed.






SHIFT T

At most points where the computer is waiting for a response, holding down the **SHIFT** key while pressing **T** will terminate the program. (For exceptions, see the note about **SHIFT T** on page 41.)








SHIFT 

If you want to use the placement mode, or change the number of problems or length of time-out, press **SHIFT**  after the computer asks, "What is your first name?".



SHIFT 

Holding the **SHIFT** key down and pressing  causes the computer to "freeze" on the current screen until another key is pressed. The student may want to use **SHIFT**  after a problem has been completed in order to study it more carefully. Be sure when you use **SHIFT**  to release the  key quickly after you have pressed it. On the Model III, holding the  key down will keep the feature from working.


The "up symbol"  , "down symbol"  , or arrow  shows the student where his or her answer will appear on the screen. If you are using the TRS-80 Model I computer, you will see the "up-arrow"  instead of  and the "down-arrow"  instead of .




The "left-arrow" key  or the "right-arrow" key  can be used to erase characters when typing in a name or lesson number. These two keys can also be used to correct digits in a multi-digit student response (except where the computer checks each digit individually for accuracy, and except where the last character of the answer has already been typed in). Use the "left-arrow" to erase one character to the left, or use the "right-arrow" to erase one character to the right.

LOADING ESSENTIAL MATH PROGRAMS

Using the Computer Tape System

Two Essential Math programs are recorded on each of the five cassette tapes provided (one program per side). Each side contains two copies of the same program.

To load the desired program into the computer follow these steps in exact order:

TRS-80 Model I and Model III

1. a. If you are using a Model I computer, turn on the video display by pressing the power button. Next, turn on the keyboard by pushing in the power button on the back.

b. If you are using a Model III computer, turn on the computer. (The On/Off switch is under the right side of the keyboard.)
2. Place the selected program cassette in the cassette recorder. (For this example, let's choose the cassette with Fractions 1.)
3. Set the volume level of the cassette recorder between 5 and 7.
4. Press "REWIND." When the cassette is rewound, press "STOP," then press "PLAY."
5. If you are using a Model III: When **Cass?** appears on the video display, press **L**.
6. When **Memory Size?** appears on the video display, press **ENTER**.
7. Type **C L O A D**, then press **ENTER**. If the program is loading properly, two asterisks will appear in the upper right corner of the screen. The right asterisk will blink.)*

*If the asterisks do not appear after several seconds:

- press "STOP"
- turn the volume a little higher
- press the RESET button (at the rear of the Model I keyboard, and on the right side of the Model III keyboard)
- repeat the instructions from Step 4.

If the asterisks appear, but the right one does not blink:

- press "STOP"
- turn the volume a little lower
- press the RESET button (at the rear of the Model I keyboard, and on the right side of the Model III keyboard)
- repeat the instructions from Step 4.

8. When the **READY** prompt appears on the screen, press the "STOP" button, then press "REWIND" to rewind the tape on the recorder. Next, remove the tape and replace it in the cassette holder to protect it from damage.
9. Type **R** **U** **N** and press **ENTER**. You'll see the title screen appear on the video display.

To begin working with the Fractions 1 program, turn to page 14.

Using the Computer Disk System

To load the desired program into the computer, follow these steps in exact order:

TRS-80 Model I

1. Turn on the expansion interface, disk drive(s), and video display.
2. Place the desired Model I diskette with the square notch up and the label to the right in DRIVE 0 (DRIVE 0 is the disk drive closest to the expansion interface), and close the door. For this example, let's choose the diskette with Fractions 1.
3. Turn on the keyboard by pushing in the power button located on the back to the left of the power jack.
4. When **DOS READY** appears on the screen, type **B A S I C**, then press **ENTER**.
5. When **HOW MANY FILES?** appears on the screen, press **ENTER**. When **MEMORY SIZE?** appears on the screen, press **ENTER** again.
6. Type **R U N " F R A C T 1 "** (for the Fractions 1 program) and press **ENTER**. You'll see the title screen appear on the video display.

To begin working with the Fractions 1 program, turn to page 14.

TRS-80 Model III

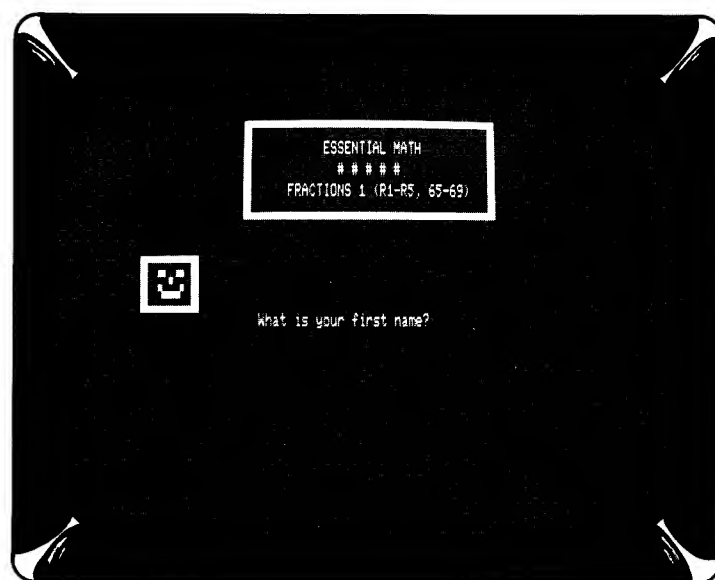
1. Turn on the computer. (The On/Off switch is under the right side of the keyboard.)
2. When the red light goes off, insert the Model III program diskette in DRIVE 0 (the bottom drive) with the square notch to the left and the label facing up, and close the door.
3. Press the orange RESET button.
4. Type the date, being sure to use two digits each for the month, day, and year, with a slash separating each pair. (Example: **0 1 / 0 9 / 8 2** for September 1, 1982. Then press **ENTER**).
5. Enter the time OR simply press **ENTER**. (If you enter the time, be sure to use two digits each for the hour, minutes, and seconds, with a colon separating each pair.)
6. When **TRSDOS Ready** appears on the screen, type **B A S I C** **ENTER**.
7. When **How Many Files?** appears on the screen, press **ENTER**. When **Memory Size?** appears on the screen, press **ENTER** again.

8. For this demonstration, let's run the Fractions 1 program. When the **READY** prompt appears, type **R U N " F R A C T 1 "** (for the Fractions 1 program) and press **ENTER**. You'll see the title screen appear on the video display.

To begin working with the Fractions 1 program, turn to page 14.

USING THE FRACTIONS 1 PROGRAM

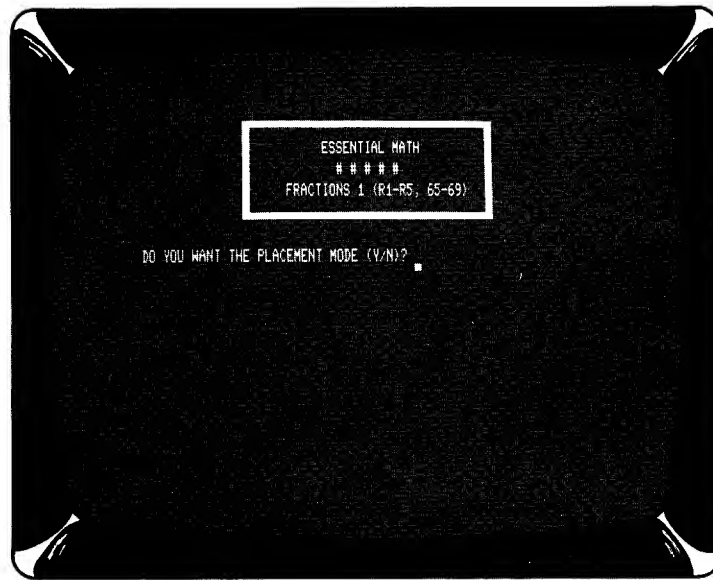
After your Fractions 1 Program is loaded and running, you'll see the title screen appear:



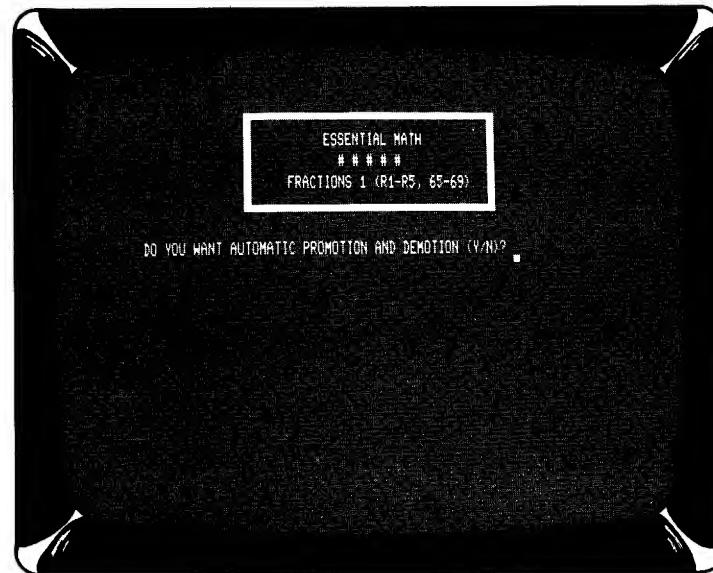
Placement Mode

The first thing to do when you start a student in one of the Essential Math programs is to determine where in the lesson sequence he or she should begin. Each of the programs in Essential Math, Volume Two, contains a placement mode to help you make this decision. The placement feature measures a student's current level of ability and places that student automatically in the appropriate lesson for further practice. Let's see how this works.

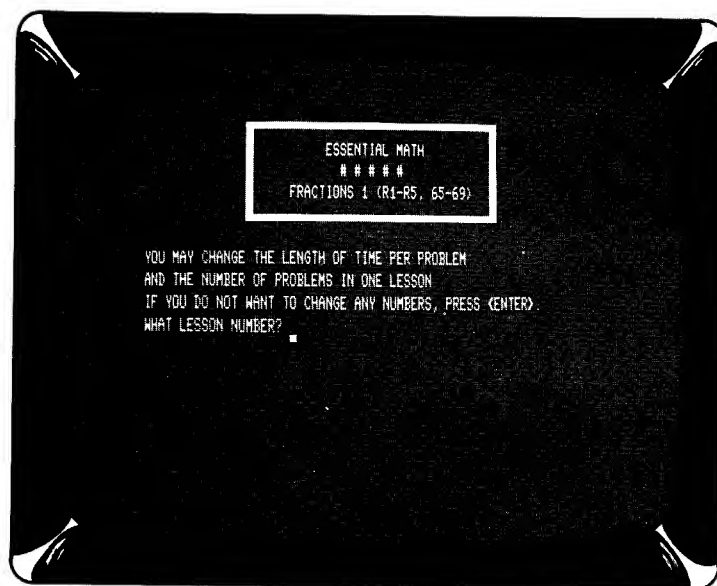
Notice the question, "**What is your first name?**" in the middle of the title screen. If you type the student's name and press **ENTER**, you can start the student in the lesson of your choice. However, we want the placement mode to help us choose a lesson, so let's type **SHIFT** **↑** instead of a name. (The up-arrow **↑** is on the left side of the keyboard.) You will see:



Type **Y** and press **ENTER** in response to the question, “DO YOU WANT THE PLACEMENT MODE (Y/N)?” When you do, you’ll see, “DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?”:



Automatic promotion and demotion is a feature available for use with the skill building mode (see **PROMOTION / DEMOTION FEATURE** on page 23). Since you are currently setting up for the placement mode and do not need this feature, type **N** for NO and press **ENTER**. You’ll see the following message appear on your screen:

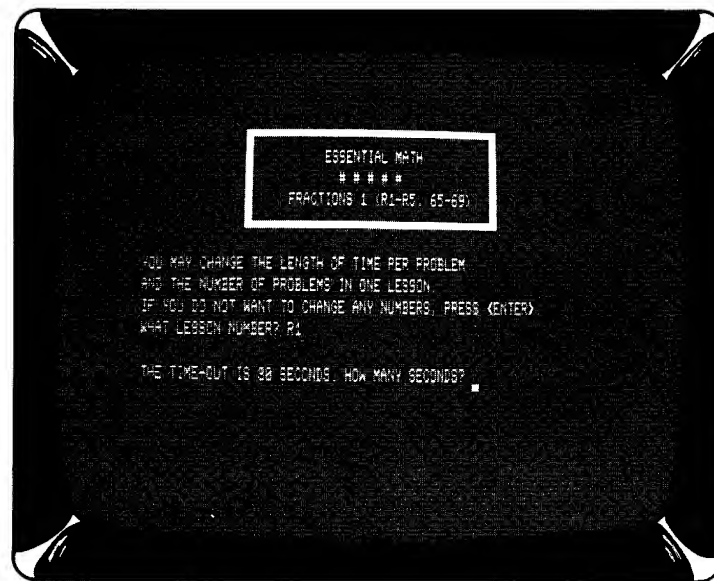


Making Changes in the Program

The screen tells you that in addition to choosing a lesson number, you have the option of changing the length of time per problem and the number of problems in the lesson. Begin by choosing the lesson you think may be appropriate for this student. (It is probably better to start low, rather than high, so the student will be encouraged by being promoted to an appropriate level. The Fractions section of **APPENDIX I, LESSON CONTENT SUMMARIES**, can help you estimate the beginning lesson.)

Let's assume that you do not know the student's background or ability, and so you start him or her in the first lesson. Type **R 1** and press **ENTER**.

Note: If you accidentally type the wrong letter or number, you can change it *before* you press **ENTER** by backspacing with the **←** key and then typing the correct letter or number.

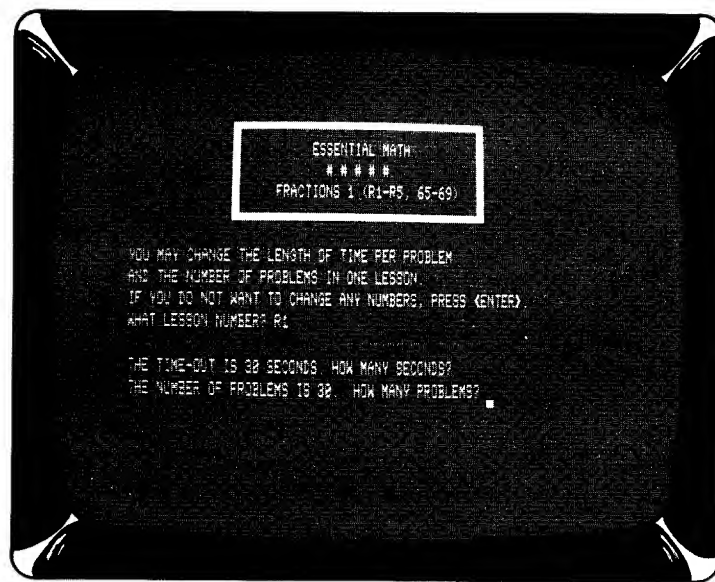


The message, "THE TIME-OUT IS 30 SECONDS", means that the student will have 30 seconds to respond to a question before the word "TIME" appears on the screen. (The "TIME" message is used to encourage quicker thinking, and is not considered in evaluating a student's response. The student can go on to answer the question after the "TIME" message appears.)

If you want to change the time-out, type in the desired number of seconds and press **ENTER**. If you decide to leave the time-out as it is, simply press **ENTER**.

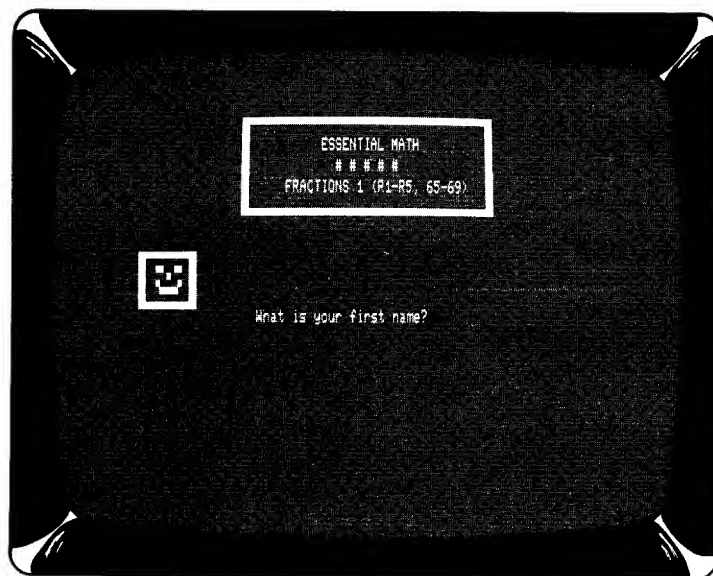
Note: Whenever you are given the option to change something in a lesson and you simply press **ENTER**, the computer will automatically assign a pre-determined value for you. We call this pre-determined value the *default* value. If you chose not to change the time-out, you pressed **ENTER** and the default value of 30 seconds was automatically assigned.

Next you'll see:

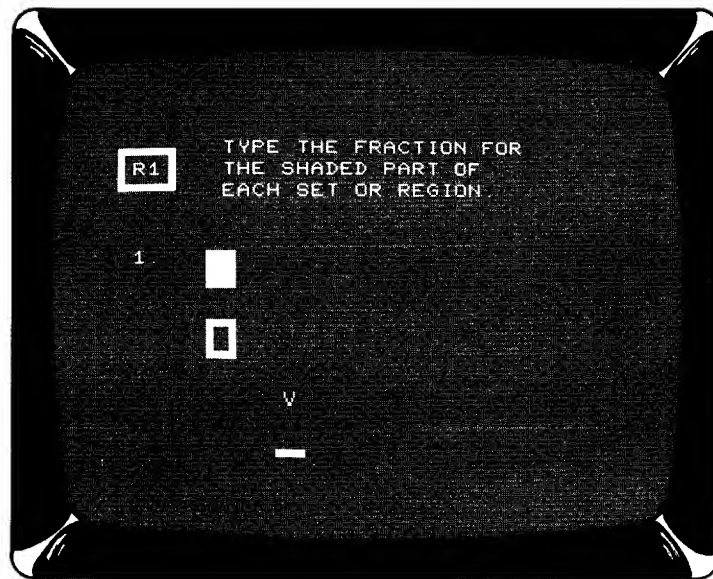


Lesson R1 contains 30 problems. At this point, you have the option to change the number of problems in the lesson (the new number must be between 0 and 100). If you press **ENTER** without typing a number, the number of problems remains at the default value of 30. For placement purposes, however, a few problems should be sufficient. Let's type **3** and press **ENTER**.

After you have changed the number of problems the title screen reappears:



The student can now begin to work with the program. When the student types in his or her name (using as many as 15 letters) and presses **ENTER**, the first problem appears on the screen:



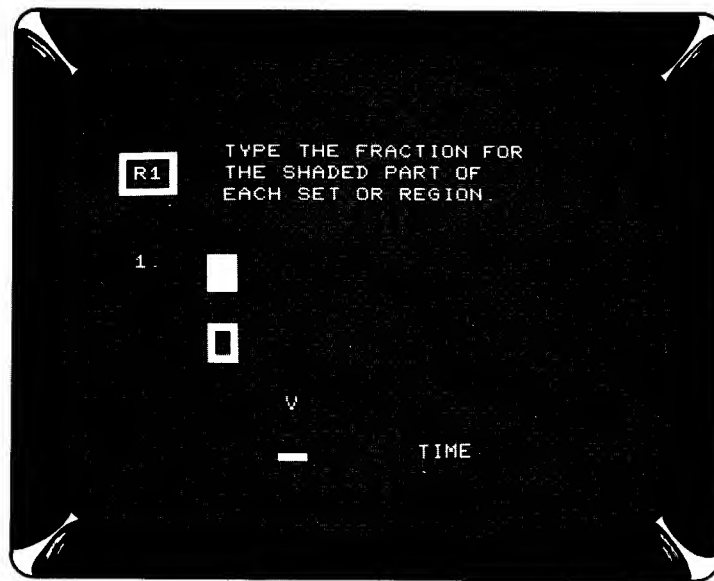
Since Essential Math problems are randomly generated by the computer, your screen probably does not show this same problem. What you have is a similar problem which was generated using the specifications for this particular lesson. (The specifications for all lessons are given in **APPENDIX I, LESSON CONTENT SUMMARIES.**) For this particular lesson, you'll see a diagram that represents a fraction. To solve the problem, type the fraction which the diagram represents.

Answering a Problem

The pointer on the screen shows the student where his or her response will appear. When the student types the correct numerator, the pointer will move to the denominator's place for the next response.

If the student enters an incorrect numerator, a **"PLEASE TRY AGAIN"** message is displayed. If the second response is also incorrect, the correct answer then appears. The student must type the correct answer in order to continue. When the entire problem has been completed correctly, the program moves on to the next problem.

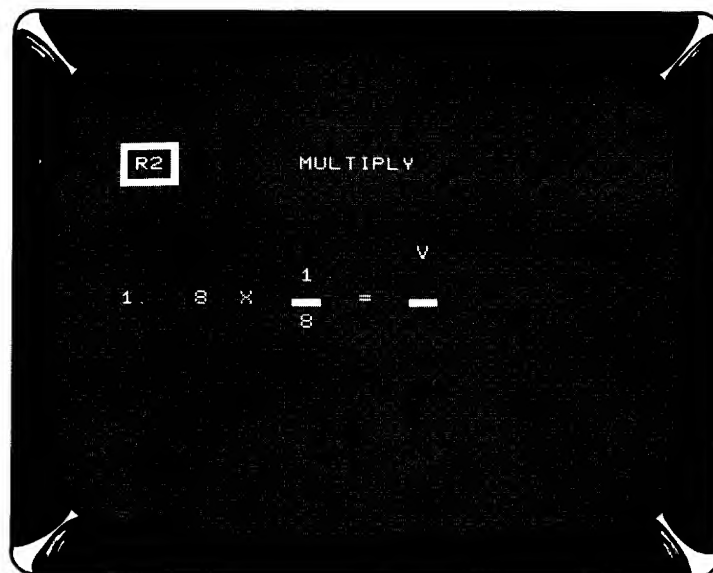
Now look at your screen. If you did not change the length of time-out earlier, a **"TIME"** message was displayed 30 seconds after the problem appeared:



Now work the problem correctly. Be careful when typing in your response, because in this lesson mistakes cannot be corrected! You must type both the numerator and the denominator correctly on the first try for the problem to be considered correct.

When you have completed the first problem, two more problems from Lesson R1 will appear in turn. Answer them correctly also.

Since you have done well on Lesson R1, the computer will present you with three problems from Lesson R2. Your screen will look similar to this:



Notice that the box in the upper left corner now says "R2." This box always displays the current lesson number.

Now answer the problem incorrectly to see how the computer reacts to an incorrect response.

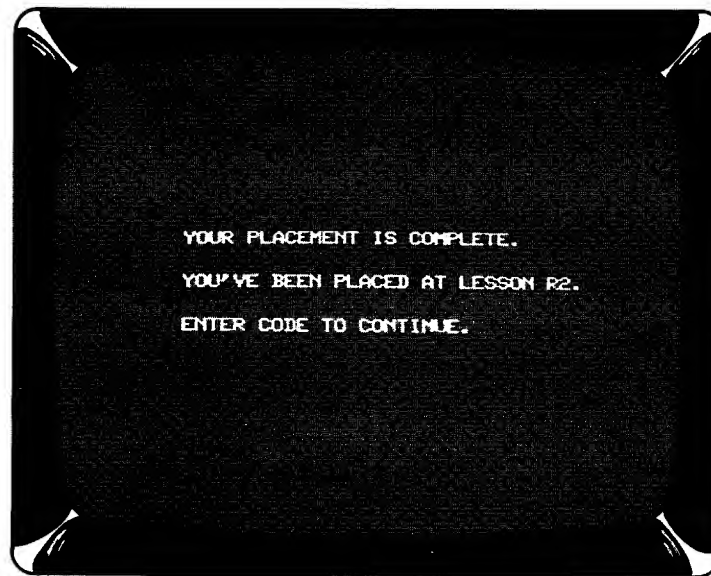
Self-Pacing Feature

While you have been working with the program you have probably noticed that a problem remains on the screen a few seconds after it has been completed. This is to allow the student time to think about his or her response. The student can speed up the appearance of the next problem by using the self-pacing feature. If the student presses any key on the keyboard after completing a problem, the computer will proceed immediately to the next problem. (Note: Exceptions are the **BREAK** and **SHIFT** keys.)

Work the next two problems (correctly or incorrectly), and use the self-pacing feature to eliminate the pause at the end of a problem.

Placement Report

Notice that when you finish your problems this screen appears:



Because you answered fewer than 90% of the problems in R2 correctly, you were not given three more problems from the next lesson (R3), but were placed in R2 for more practice. (See **PLACEMENT MODE** on page 14 for more details on how the placement process works.)

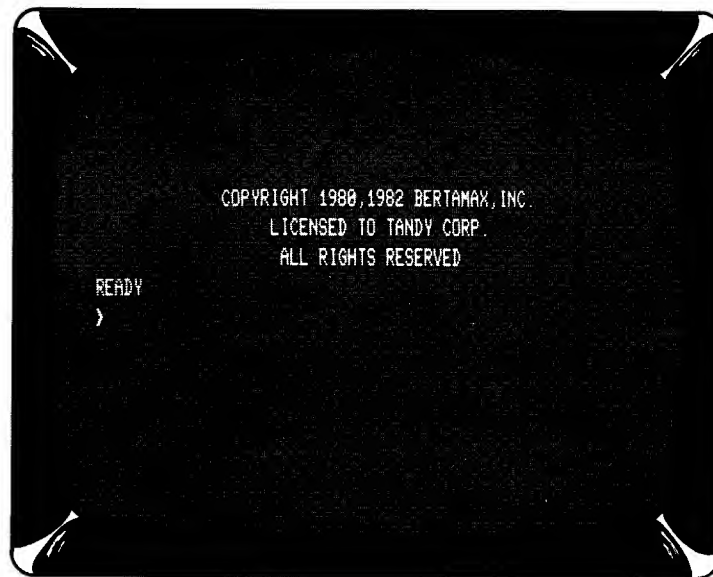
If a student had been working with the program, you would at this point record on the student's Record Sheet the number of the lesson where placement was made. (Samples of the Student Record Sheet are included in this manual at the end of this section.) When placement is made, you have two options available:

1. You can let the student begin working in the lesson in which he or she was just placed. To allow this student to begin working in Lesson R2 where placement was

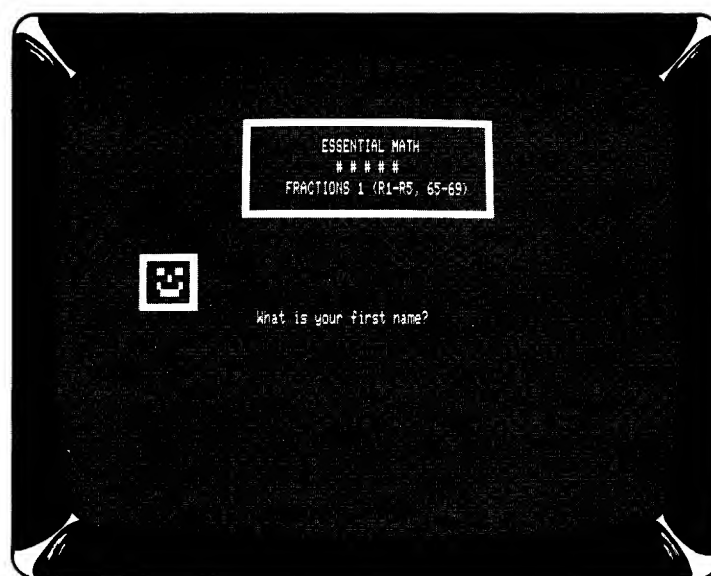
made, you would press **SHIFT** **S**. The student could then work the 30 problems in Lesson R2.

2. Alternatively, you can end the program by pressing **SHIFT** **T** while the placement report is displayed. Once you had terminated the program, you could place another student (by typing **R** **U** **N** **ENTER** and repeating the procedure you've just followed), or you could start a student in any lesson in the Fractions 1 program (including Fractions lesson R1 to R5 and 65 to 69).

Let's end the program and then work through a lesson just as a student would. Press **SHIFT** **T** and this screen appears:



To get back to the beginning of the program, type **R** **U** **N** and press **ENTER**. You'll be returned to the title screen:



Skill Building Mode

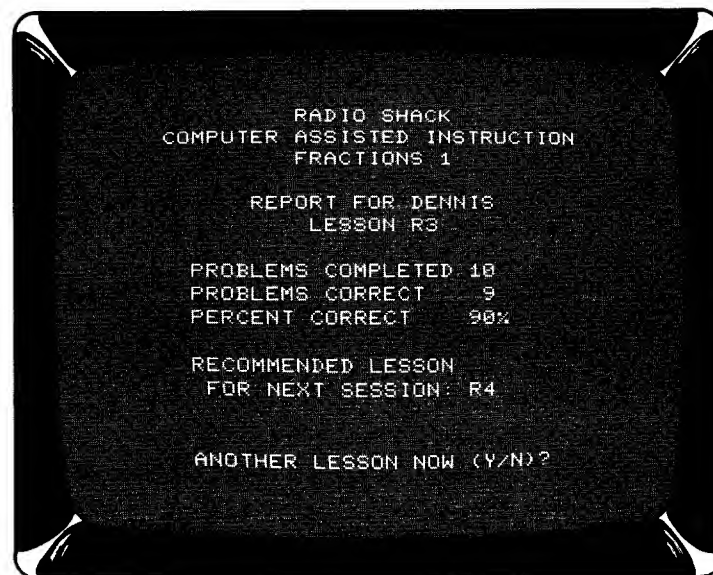
This time let's try working in the skill building mode. Instead of typing your name, press **SHIFT** **↑**. When the question, "**DO YOU WANT THE PLACEMENT MODE (Y/N)?**" appears on the screen, type **N** for NO. The question, "**DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?**", appears next; type **Y** for YES. When you see the question, "**WHAT LESSON NUMBER?**", type **R** **3** and press **ENTER**.

The program will tell you that the time-out is 30 seconds. Press **ENTER** to leave the seconds of time-out at the default value of 30. Now when you see "**THE NUMBER OF PROBLEMS IS 30. HOW MANY PROBLEMS?**", type **1** **0** and press **ENTER**.

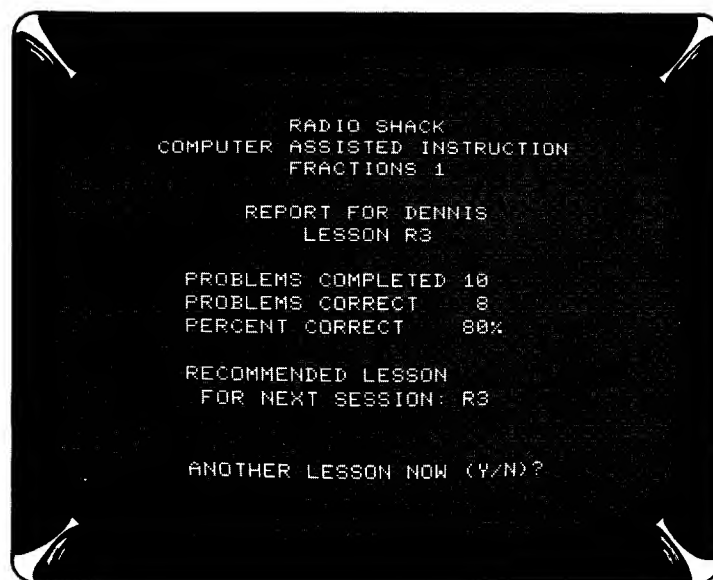
Next the title screen with the question, "**What is your first name?**" appears. After typing your name and pressing **ENTER**, work the ten problems, answering some right and some wrong. Notice that a positive reinforcement message appears from time to time when you answer a problem correctly.

Promotion / Demotion Feature

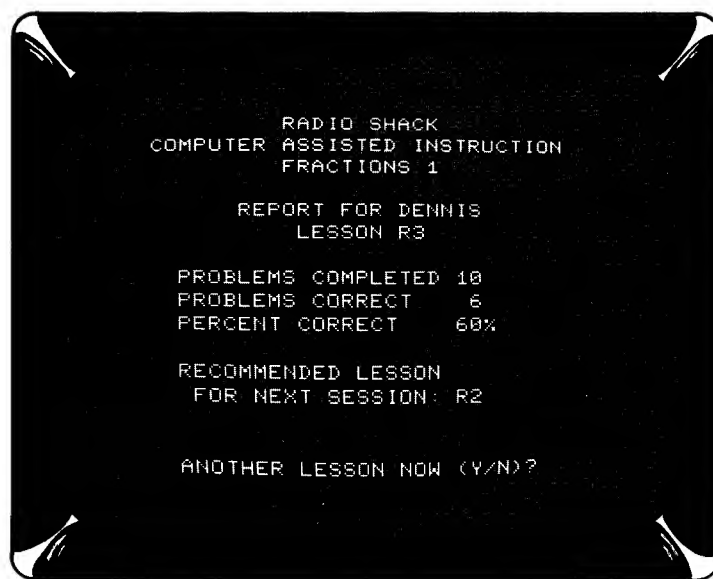
When you have completed all ten problems, a report appears on the screen. If you've worked 90% or more of the problems correctly, you'll be promoted to the next lesson:



If your score is 70% to 89%, you'll be told to repeat the same lesson:



If you've answered less than 70% of the problems correctly, you'll be sent back to Lesson R2 for further review:



This automatic promotion/demotion feature lets a student advance within a program at his or her own rate, and sends the student back to earlier lessons for review if necessary. The student must learn the skills in each lesson to mastery level (score of 90% or higher) before being permitted to move on to a more difficult lesson.

Note: A report can be requested at any time during a lesson, regardless of the number of problems worked so far. See the **SHIFT S** paragraph on page 41 for details on how this is done.

Whenever a student report appears on the screen, you should record the number of the student's next lesson on that student's Record Sheet.

At the bottom of the report screen you'll see the question, "**ANOTHER LESSON NOW (Y/N)?**" The student can respond in one of three ways:

- type **Y**, and work on the next lesson as specified in the report.
- type **N**, and return to the title screen so another student can begin work.
- type **SHIFT T** and end the Fractions 1 program. This allows you to run a different lesson in the same program by typing **R U N ENTER**, or to run a different program. (See the **SHIFT T** section on page 40 for a detailed description of what **SHIFT T** will do.)

You can now practice further with the Fractions 1 program if you wish, using this section of the manual as a guide. If you want to change programs, see the **DIRECTIONS FOR RUNNING A NEW PROGRAM** on page 26. If you are ready to stop for now, simply remove and store the cassette or diskette and then turn the computer off.

Note: Be sure to remove the diskette from the disk drive before you turn off the computer. Failure to do so could damage your diskette.

DIRECTIONS FOR RUNNING A NEW PROGRAM

Using the Computer Tape System

When you want to work with a different program, press **SHIFT** **T** while the computer is waiting for a response. (See the **SHIFT** **T** paragraph on page 40 for details on when **SHIFT** **T** can be used.) This screen appears:

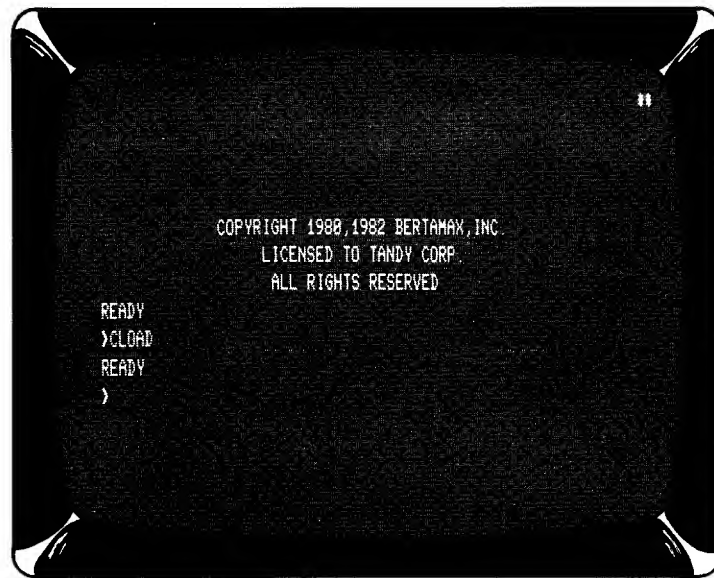


To change programs follow these simple steps:

1. Put the desired tape into the cassette recorder.
2. Press "REWIND" if the entire tape is not wound onto the left reel.
3. Make sure the volume level is still between 5 and 7 and press "PLAY."
4. Type **C** **L** **O** **A** **D** and press **ENTER**.

(If the program is loading properly, two asterisks will appear in the screen's upper right corner. The asterisk on the right will blink as the program loads.)

After the program is loaded, the screen will look like this:

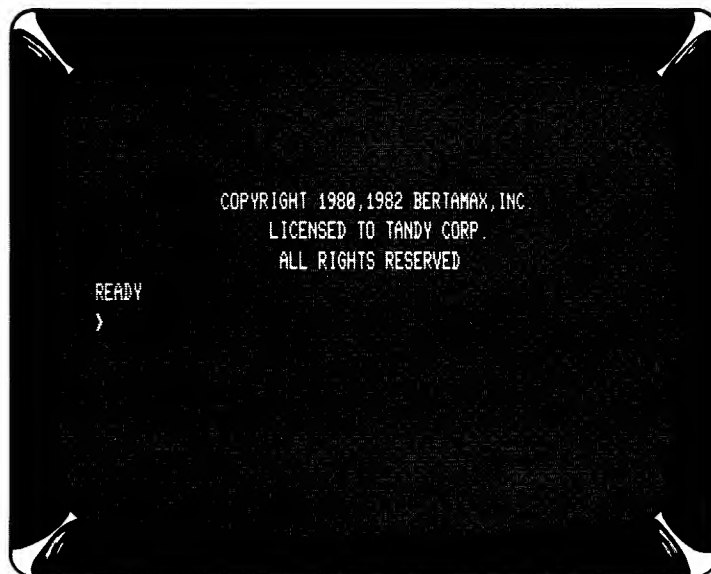


5. Type **R** **U** **N** and press **ENTER**.

Now you can begin working with the new program.

Using the Computer Disk System

When you want to work with a different program, press **SHIFT T** while the computer is waiting for a response.* This screen appears:



If the new program you wish to run is stored on the same diskette, type **R U N** followed by the disk filename in quotes and press **ENTER**. (For example, **R U N " F R A C T 2 " ENTER**.) If you must change diskettes, place the diskette containing the desired program with the square notch to the left and the label facing up in Drive 0 (the bottom drive). If you are using a TRS-80 Model I, place the diskette with the square notch up and the label on the right in the disk drive. Type **R U N** followed by the disk filename in quotes and press **ENTER**.

Note: The disk filenames of all the programs in the Essential Math Program, Volume Two are as follows (these names can be found on the diskettes that come with the package):

<u>Filename</u>	<u>Program</u>
FRACT1	Fractions Lessons R1-R5 and 65-69
FRACT2	Fractions Lessons 70-82
FRACT3	Fractions Lessons 83-90
DEC1	Decimals and Percent Lessons R1-R5 and 65-69
DEC2	Decimals and Percent Lessons 70-76
DEC3	Decimals and Percent Lessons 77-83
DEC4	Decimals and Percent Lessons 84-90
PREALG1	Pre Algebra Lessons R1-R5 and 65-72
PREALG2	Pre Algebra Lessons 73-84
PREALG3	Pre Algebra Lessons 85-90

*See the **SHIFT T** paragraph on page 40 for details as to when **SHIFT T** can be used.

Student's Name	TEREKY JAMILA
Scheduled Time	9:30 - 9:40

[illegible]

Student's Name	Scheduled Time
----------------	----------------

[illegible]

MORE INFORMATION ABOUT THE PROGRAM

LESSON SEQUENCE

Lessons in each of the Fractions, Decimals and Percent, and Pre-Algebra lesson series are spread over three to four computer programs, and are sequenced in order of increasing difficulty. Conceptual steps between lessons are kept as small as possible. Lessons are numbered from R1 to R5 (review lessons) and from 65 to 90 (regular lessons).

To aid the teacher in determining where to place students, and in deciding how to use Essential Math lessons with the school's curriculum, a summary of the contents of each lesson appears in **APPENDIX I, LESSON CONTENT SUMMARIES**.

Fractions

The first lesson in the Fractions sequence provides practice in basic fractions concepts by asking the student to identify the fraction that is represented by a diagram on the screen. In later lessons, the student compares and reduces fractions and multiplies, divides, adds, and subtracts fractions and mixed numbers. There are three computer programs for Fractions.

Decimals and Percent

The Decimals and Percent lesson sequence begins with problems in adding, subtracting, and multiplying decimal numbers that represent money. In later lessons, the student writes decimals as fractions, determines place value in decimal numbers, and multiplies, divides, adds, and subtracts decimals. Percent exercises include converting fractions and decimals to percents, finding percentages of whole numbers, and finding particular numbers by knowing percentage relationships. There are four computer programs for Decimals and Percent.

Pre-Algebra

Lessons in the Pre-Algebra sequence relate familiar mathematical concepts, and concepts learned in the Fractions and Decimals and Percent sequences, to negative numbers and to equations containing variables. The student solves addition, subtraction, multiplication, and division equations using positive and negative integers, fractions, and decimals. There are three computer programs for Pre-Algebra.

PLACEMENT MODE

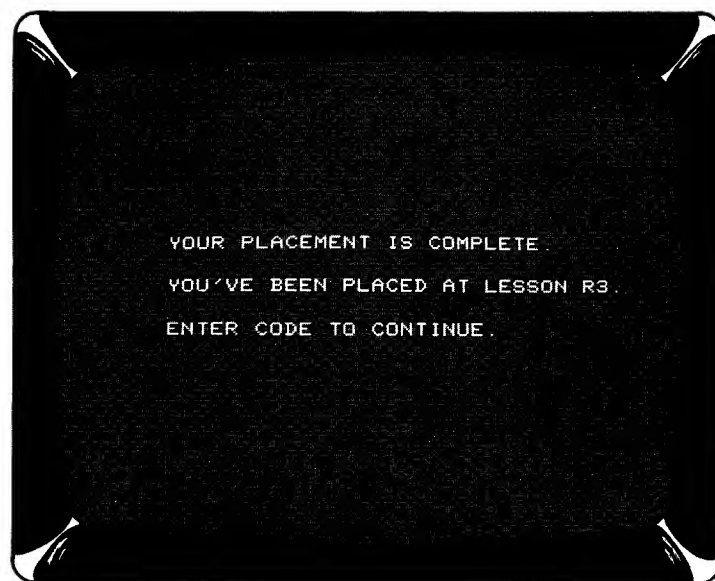
Each program in Essential Math, Volume Two is provided with a placement mode which measures a student's present ability and places that student automatically in the appropriate lesson. The placement mode moves a student rapidly forward or backward within the program until the proper level for that student is found. Before beginning the placement process, you must estimate the student's starting level. The **LESSON CONTENT SUMMARIES (APPENDIX I)** should help in choosing a probable starting lesson. If you are not sure of a student's current level, just start the student with the first lesson in the program to avoid the discouragement of too many demotions.

To use the placement mode, press **SHIFT** **↑** when you see the question "What is your name?" on the title screen. (If you run the program without pressing **SHIFT** **↑** at this point, the student is automatically started in the skill building mode.) When the question, "DO YOU WANT THE PLACEMENT MODE (Y/N)?", appears, type **Y** and press **ENTER**. Next the question, "DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?", appears on the screen; specifying **Y** or **N** determines whether this feature is in effect for any lesson(s) the student takes immediately after placement. (The recommended lesson is presented immediately if **SHIFT** **S** is pressed when a placement report is on the screen.) Now when the question, "WHAT LESSON NUMBER?", appears, type the estimated starting lesson and press **ENTER**. To change time-out and number of problems, type the appropriate number and press **ENTER** at the questions, "HOW MANY SECONDS?" and "HOW MANY PROBLEMS?".

After you have made any desired changes, the computer goes to the starting lesson you selected and gives the number of problems you specified. One of the following then happens:

- If the student answers between 70% and 89% of the problems correctly, the program will consider that lesson the appropriate placement level.
- If the student scores less than 70%, the computer will move down to the previous lesson and give the same number of problems in that lesson. The student will continue to move back through the lessons until he or she scores 70% or better on a given set of problems.
- If the student scores 90% or better, the computer will present the same number of problems in the next lesson. The student will continue to move forward until he or she scores less than 90% on a given set of problems.

When one of these situations occurs, placement is complete and a report appears on the screen giving the placement information:



Note that the promoting and demoting described above takes place *only if* the student has not been moving in the opposite direction previously. For example, if the student has been advancing and then scores less than 90% on a given set of problems, he or she is placed at that lesson, never demoted to a lesson through which he or she has already advanced. The current lesson level is indicated at all times in the upper left corner of the screen.

The following examples provide an illustration of the placement process:

EXAMPLE #1

- The instructor selects Lesson R4 to initiate the placement process and sets the number of problems at ten.
- Student solves all ten problems correctly (100%).
- Ten problems are presented from Lesson R5.
- Student solves nine problems correctly (90%).
- Ten problems are presented from Lesson 65.
- This advancement procedure continues until the student misses at least two problems (for a score of less than 90%), or reaches the last lesson in the program.

EXAMPLE #2

- The instructor selects Lesson R4 to initiate the placement process and sets the number of problems at ten.
- Student solves nine or ten problems correctly (90% or better).

- Ten problems are presented from Lesson R5.
- Student solves eight or fewer problems correctly (less than 90%).
- The placement process is terminated and the student is placed at Lesson R5 for skill building lessons.

EXAMPLE #3

- The instructor selects Lesson R4 to initiate the placement process and sets the number of problems at ten.
- Student solves six or fewer problems correctly (less than 70%).
- Ten problems are presented from Lesson R3.
- Student solves six or fewer problems correctly (less than 70%).
- Ten problems are presented from Lesson R2.
- This demotion procedure continues until the student solves at least seven problems correctly (for a score of 70% or better), or reaches the first lesson in the program.

EXAMPLE #4

- The instructor selects Lesson R4 to initiate the placement process and sets the number of problems at ten.
- Student solves six or fewer problems correctly (less than 70%).
- Ten problems are presented from Lesson R3.
- Student solves seven or more problems correctly (70% or better).
- The placement process is terminated and the student is placed at Lesson R3 for skill building lessons.

EXAMPLE #5

- The instructor selects Lesson R4 to initiate the placement process and sets the number of problems at ten.
- Student solves seven or eight problems correctly (70% or 80%).
- The placement process is terminated and the student is placed at Lesson R4 for skill building lessons.

If the student scores less than 70% on the first lesson or more than 90% on the last lesson in the program, then that lesson will be considered the appropriate placement level.

Note: If the student presses **SHIFT** **S** when a placement report is on the screen, he or she enters the skill building mode. The number of skill building problems then presented will be the default (pre-determined) number for that lesson; however, the time-out will remain as you specified when setting up for the placement mode.

SKILL BUILDING MODE

After you place a student in one of the Essential Math lessons (with or without the help of the placement mode), the student is ready to begin working skill building problems. The special features that are available to both student and teacher in the skill building mode increase the versatility of the programs.

SHIFT **↑**

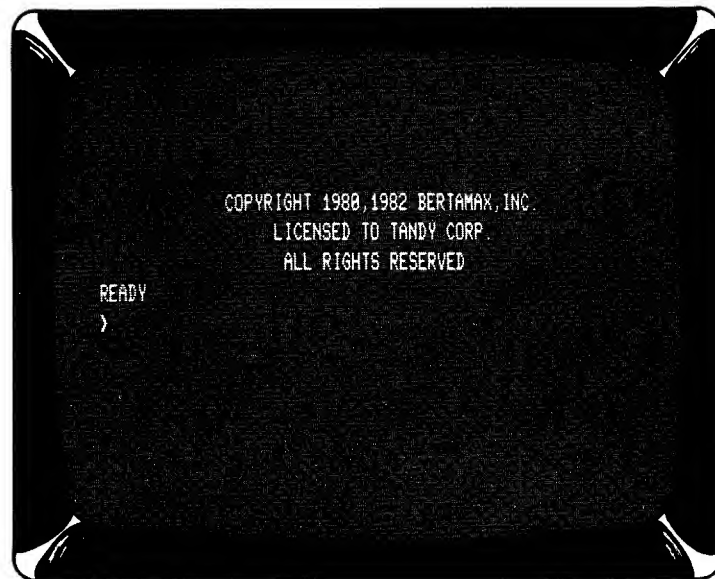
The **SHIFT** **↑** option can be used only when the title screen with the question, “**What is your first name?**” is displayed. When you press **SHIFT** **↑** at this point, the question, “**DO YOU WANT THE PLACEMENT MODE (Y/N)?**” appears. Type **N** and press **ENTER** to allow the student to work lessons in the skill building mode. Now you can choose to use the promotion/demotion feature, select the lesson number, and change the length of time-out and/or the number of problems to be presented. To do this, simply type your answer and press **ENTER** as each of these questions appears:

DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?
WHAT LESSON NUMBER?
HOW MANY SECONDS?
HOW MANY PROBLEMS?

Any changes that you make when you answer these questions will be in effect for the lesson you specified and for any other lesson(s) which the student takes at the same sitting (until the program is terminated or returned to the title screen). That is, these changes will remain in effect from lesson to lesson as long as the student moves from lesson to lesson by typing **Y** in response to the question, “**ANOTHER LESSON NOW (Y/N)?**”.

SHIFT **T**

The **SHIFT** **T** option can be used to terminate the program at almost any point where the computer is waiting for a response. Pressing **SHIFT** **T** will produce this screen:



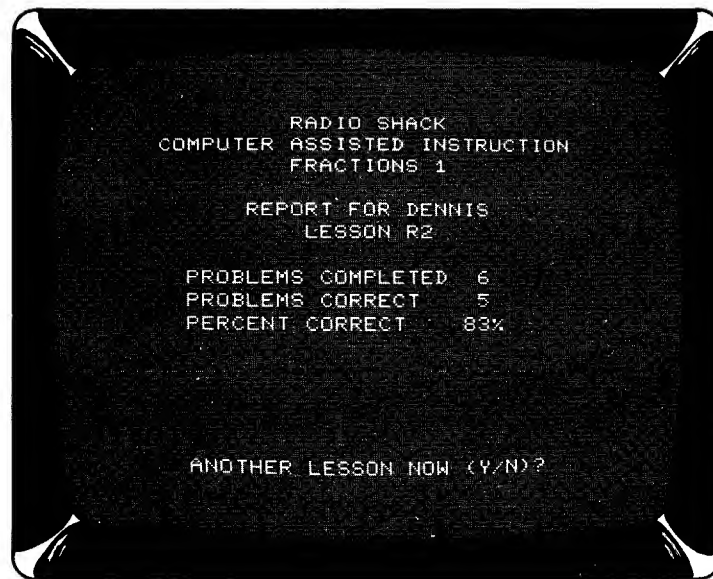
At this point, you can run the same program again by typing **R U N** and pressing **ENTER**, or you can change to a different program by following the **DIRECTIONS FOR RUNNING A NEW PROGRAM** on page 26.

Note: **SHIFT T** can *not* terminate the program while text is being printed on the screen, at the question, "What is your first name?", or as the following five questions appear (a result of the teacher choosing **SHIFT ↑** option):

DO YOU WANT THE PLACEMENT MODE (Y/N)?
DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?
WHAT LESSON NUMBER?
HOW MANY SECONDS?
HOW MANY PROBLEMS?

SHIFT S

When a student is working on problems in the skill building mode, you can get a progress report *before* the lesson is completed by pressing **SHIFT S**. A report will appear showing the number of problems completed up to that point, the number of those problems completed correctly, and the percentage of problems completed correctly. The computer will not promote or demote the student; the full number of problems for that lesson (as specified by the program, or as modified by the teacher) must be completed for the promotion/demotion feature to operate. The student is then asked if he or she wants another lesson now. If the student responds with **Y**, the computer will return him or her to the beginning of the same lesson. If the student types **N**, the title screen will reappear. The following is an example of a report produced by typing **SHIFT S** in the middle of a lesson:



You may wish to use the **SHIFT** **S** option to give your students a timed session. Change the number of problems to the maximum of 99 (using the **SHIFT** **↑** option), give the starting signal, then press **SHIFT** **S** to get a report when the allotted time is up.

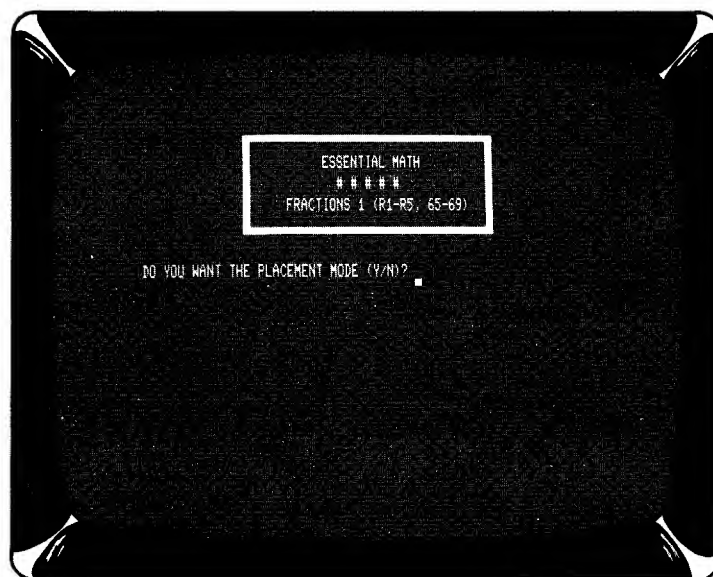
If **SHIFT** **S** is used when a placement report is on the screen, the computer will automatically start your student in the lesson where placement was made.

Promotion / Demotion Feature

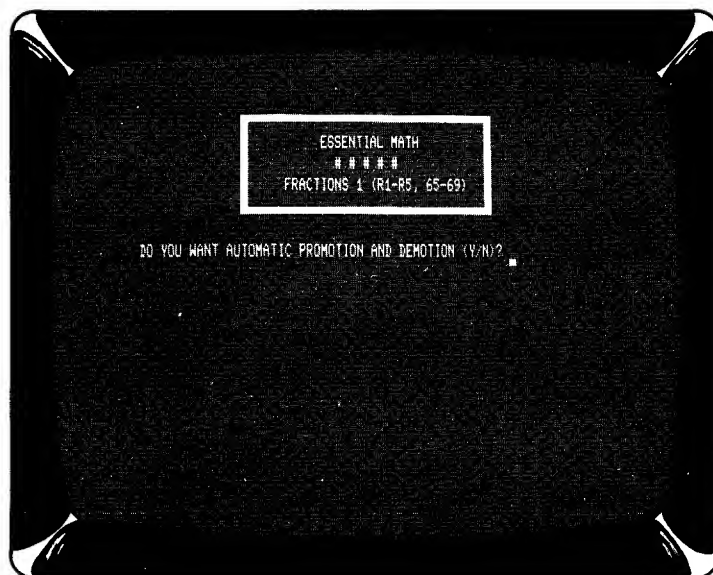
The promotion/demotion feature is *automatically* in effect if you start a student in a skill building lesson without first pressing **SHIFT** **↑** on the title screen and making changes in the program. At the end of each completed lesson a report appears on the screen giving the number of problems worked and the number and percentage of problems worked correctly. Based on the percentage of correct responses, the computer recommends the next lesson. In order to be promoted to the next level, the student must solve at least 90% of the problems correctly. If 70% to 89% of the problems are answered correctly, the student will be required to repeat the current lesson. Should the student work fewer than 70% of the problems correctly, the *preceding* lesson will be presented to further build the skills needed to complete the *current* lesson. This process of promotion and demotion helps to insure that the student attains a sufficient skill level in one lesson before moving on to more difficult lessons.

At the end of each lesson the student is asked, "ANOTHER LESSON NOW (Y/N)?". If the student types **Y**, the computer automatically begins the appropriate lesson (as determined by the promotion/demotion feature). If the student types **N**, the program will start over from the beginning to allow a new student to begin working in the program. If **SHIFT** **T** is pressed at this point, the program will end.

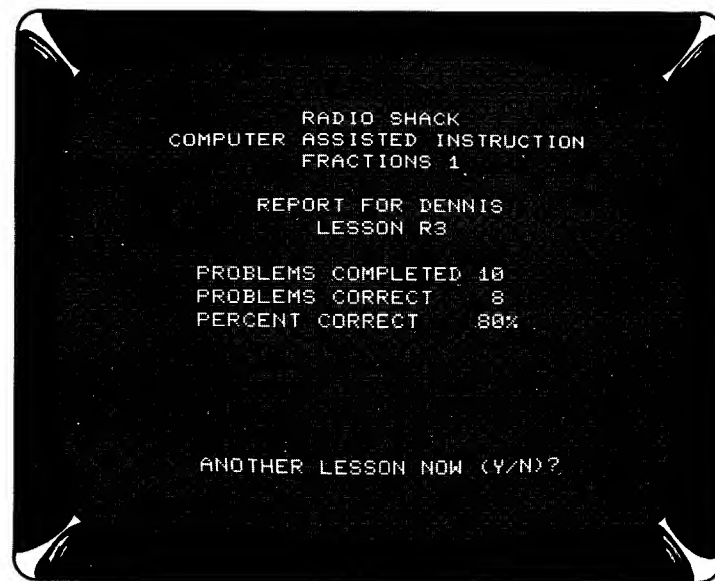
You may have the *option* of *not* using automatic promotion/demotion if you press **SHIFT** **↑** when the question, "What is your first name?", is displayed on the title screen. The computer will ask you if you want to use the placement mode:



After you type **Y** or **N**, the screen will read:



If you will not be using the placement mode, and you answer **N** to the question, "**DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION**," automatic promotion and demotion will not be in effect (that is, it will be suspended) throughout that student's sitting. When the student completes a lesson a report will be given, but the computer will not recommend the next lesson. The computer will, however, give the student the option of taking "**ANOTHER LESSON NOW (Y/N)?**":



If the student types **Y** to take another lesson, he or she will return to the beginning of the lesson just taken, no matter what his or her score was, because the automatic promotion/demotion feature is not operating. This allows a student whose score was unsatisfactory to retake the lesson immediately and try for improvement. Should the student type **N** in response to the question, “**ANOTHER LESSON NOW (Y/N)?**”, the title screen will appear.

Automatic promotion and demotion operates only in the skill building mode (not in the placement mode). If you are using the placement mode and answer **N** to the question “**DO YOU WANT AUTOMATIC PROMOTION AND DEMOTION (Y/N)?**”, then the promotion/demotion feature will be suspended when the student enters the skill building mode immediately after placement, and will remain suspended throughout that sitting. If you are using the placement mode and type **Y** in response to the above question, then the promotion/demotion feature will begin to operate as soon as the student enters the skill building mode after placement.

Self-Pacing Feature






A student can partially control the rate at which new problems appear on the screen by means of the self-pacing feature. By pressing any key on the keyboard after a problem has been completed, the student can eliminate the pause between problems and cause the next problem to appear immediately. (Exceptions are the **BREAK** and **SHIFT** keys.) This feature can also be used while working problems in the placement mode.

Reinforcement Messages

Various reinforcement messages give the student immediate feedback as to how he or she is doing with a problem. For example, the “**TIME**” message tells the student when he or

she is taking too much time to enter a response. After an incorrect response, "**PLEASE TRY AGAIN**" is displayed. After two incorrect responses, the correct answer appears. When a student correctly answers a problem on the first try, a message such as "**CORRECT!**" or "**GOOD JOB!**" may appear on the screen.

(Left-arrow key) and (Right-arrow key)



The left-arrow key  or the right-arrow key  can be used in some parts of the program to erase mistakes. When the teacher is loading the program or setting up the lesson (i.e., answering questions which refer to placement mode, promotion/demotion feature, lesson number, time-out, number of problems, or student's name), corrections within a line can be made using the left-arrow key  before **ENTER** is pressed. In most lessons, the student can make corrections before the last digit of a multi-digit response is entered. If the answer is typed in from left to right, use the left-arrow key . If the answer is typed in from right to left, use the right-arrow key .

CLASSROOM MANAGEMENT

By using the individual Student Record Sheets (see sample on page 29), you can keep a detailed written account of each student's progress. Record the lesson number where the placement process was started, and the lesson where placement was made. The automatic promotion/demotion feature then allows the student to progress through the lessons at his or her own pace. At the end of each session, record the lesson(s) completed, the report scores given, and the next recommended lesson. This will tell you with which lesson that student should continue at the next session.

LESSON CONTENT SUMMARIES

FRACTIONS 1 (FRACT1)—Lessons R1–R5 and 65–69

Lesson	Content Description	Examples	
R1	<ul style="list-style-type: none"> Writing the fraction that is represented by the shaded portion of a diagram. 30 problems 	 $\frac{1}{4}$	 $\frac{3}{7}$
R2	<ul style="list-style-type: none"> Multiplying unit fractions by whole numbers 1- and 2-digit numbers Product is a fraction that can be written as a whole number 30 problems 	$\frac{1}{2} \times 10 = \underline{\hspace{2cm}}$ $\frac{1}{2} \times 10 = \frac{10}{2}$ $\frac{1}{2} \times 10 = \frac{10}{2} = 5$ $\frac{1}{9} \times 72 = \underline{\hspace{2cm}}$ $\frac{1}{9} \times 72 = \frac{72}{9} =$ $\frac{1}{9} \times 72 = \frac{72}{9} = 8$	
R3	<ul style="list-style-type: none"> Multiplying fractions by whole numbers Product is a fraction that can be written as a whole number 30 problems 	$40 \times \frac{5}{8} = \underline{\hspace{2cm}}$ $40 \times \frac{5}{8} = \frac{200}{8} =$ $40 \times \frac{5}{8} = \frac{200}{8} = 25$	
R4	<ul style="list-style-type: none"> Finding a missing numerator by multiplying by a common factor The common factor is always 2 30 problems 	$\frac{\quad}{12} = \frac{1}{6}$ $\frac{\quad}{12} = \frac{1 \times 2}{6 \times 2}$ $\frac{2}{12} = \frac{1 \times 2}{6 \times 2}$	$\frac{\quad}{14} = \frac{3}{7}$ $\frac{\quad}{14} = \frac{3 \times 2}{7 \times 2}$ $\frac{6}{14} = \frac{3 \times 2}{7 \times 2}$
R5	<ul style="list-style-type: none"> Finding a missing numerator by multiplying by a common factor The common factor is a number from 2 to 9 30 problems 	$\frac{\quad}{81} = \frac{8}{9}$ $\frac{\quad}{81} = \frac{8 \times 9}{9 \times 9}$ $\frac{72}{81} = \frac{8 \times 9}{9 \times 9}$	$\frac{8}{9} = \frac{\quad}{72}$ $\frac{8 \times 8}{9 \times 9} = \frac{\quad}{72}$ $\frac{8 \times 8}{9 \times 9} = \frac{64}{72}$

Lesson	Content Description	Examples	
65	<ul style="list-style-type: none"> Finding a missing denominator by multiplying by a common factor The common factor is a number from 2 to 9 30 problems 	$\frac{36}{\quad} = \frac{4}{9}$ $\frac{36}{\quad} = \frac{4 \times 9}{9 \times 9}$ $\frac{36}{81} = \frac{4 \times 9}{9 \times 9}$	$\frac{2}{\quad} = \frac{1}{6}$ $\frac{2}{\quad} = \frac{1 \times 2}{6 \times 2}$ $\frac{2}{12} = \frac{1 \times 2}{6 \times 2}$
66	<ul style="list-style-type: none"> Comparing fractions 1-digit numbers Student types > , < , or = 30 problems 	$\frac{5}{8} \quad \frac{7}{8}$ $\frac{5}{8} < \frac{7}{8}$	$\frac{8}{9} \quad \frac{7}{9}$ $\frac{8}{9} > \frac{7}{9}$
67	<ul style="list-style-type: none"> Comparing fractions Student finds equivalent fractions, then types > , < , or = 30 problems 	$\frac{1}{7} \quad \frac{1}{2}$ $\frac{1}{7} \times 2 < \frac{1}{2} \times 7$ $\frac{2}{14} < \frac{7}{14}$	
68	<ul style="list-style-type: none"> Finding a missing numerator by dividing by a common factor (Reducing fractions) Student uses the symbol / to represent the division sign The common factor is a number from 2 to 9 30 problems 	$\frac{\quad}{9} = \frac{20}{45}$ $\frac{\quad}{9} = \frac{20 / 5}{45 / 5}$ $\frac{4}{9} = \frac{20 / 5}{45 / 5}$	$\frac{\quad}{8} = \frac{7}{56}$ $\frac{\quad}{8} = \frac{7 / 7}{56 / 7}$ $\frac{1}{8} = \frac{7 / 7}{56 / 7}$
69	<ul style="list-style-type: none"> Reducing fractions Student supplies both parts of the new fraction Student uses the symbol / to represent the division sign 30 problems 	$\frac{20}{28} =$ $\frac{20 / 4}{28 / 4} =$ $\frac{20 / 4}{28 / 4} = \frac{5}{7}$	$\frac{7}{14} =$ $\frac{7 / 7}{14 / 7} =$ $\frac{7 / 7}{14 / 7} = \frac{1}{2}$

FRACTIONS 2 (FRACT2)—Lessons 70–82

Lesson	Content Description	Examples
70	<ul style="list-style-type: none"> • Multiplication of two fractions • Multiplicand and multiplier are unit fractions • 1-digit denominator in multiplicand and multiplier • 30 problems 	$\frac{1}{6} \times \frac{1}{2} =$ $\frac{1}{9} \times \frac{1}{5} =$
71	<ul style="list-style-type: none"> • Multiplication of two fractions • Multiplicand is a unit fraction • 1-digit denominators in multiplicand and multiplier • 30 problems 	$\frac{1}{8} \times \frac{5}{9} =$ $\frac{1}{7} \times \frac{6}{7} =$
72	<ul style="list-style-type: none"> • Multiplication of two fractions • 1-digit numerators and denominators • Later problems in the lesson may ask the student to reduce the answer • 30 problems 	$\frac{3}{7} \times \frac{3}{5} =$ $\frac{3}{5} \times \frac{7}{9} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
73	<ul style="list-style-type: none"> • Changing an improper fraction to a mixed number (problems 1–15) or changing a mixed number to an improper fraction (problems 16–30) • Whole numbers are “1” • 30 problems 	$\frac{4}{3} = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} =$ $\frac{4}{3} = \frac{3}{3} + \frac{1}{3} =$ $\frac{4}{3} = \frac{3}{3} + \frac{1}{3} = 1\frac{1}{3}$ $1\frac{1}{2} = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} =$ $1\frac{1}{2} = \frac{2}{2} + \frac{1}{2} =$ $1\frac{1}{2} = \frac{2}{2} + \frac{1}{2} = \frac{3}{2}$

Lesson	Content Description	Examples
74	<ul style="list-style-type: none"> Changing an improper fraction to a mixed number (problems 1-20) or changing a mixed number to an improper fraction (problems 21-40) Whole numbers are from 1 to 9 40 problems 	$9\frac{1}{2} = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $9\frac{1}{2} = \frac{18}{2} + \frac{1}{2}$ $9\frac{1}{2} = \frac{18}{2} + \frac{1}{2} = \frac{19}{2}$ $\frac{21}{4} = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $\frac{21}{4} = \frac{20}{4} + \frac{1}{4}$ $\frac{21}{4} = \frac{20}{4} + \frac{1}{4} = 5\frac{1}{4}$
75	<ul style="list-style-type: none"> Multiplication with mixed numbers For problems 1-15, multiplicand is a mixed number and multiplier is a whole number. Change both to fractions, then multiply. For problems 16-30, multiplicand is a mixed number and multiplier is a fraction. Change multiplicand to a fraction, then multiply. 30 problems 	$8\frac{1}{9} \times 5 =$ $\frac{73}{9} \times \frac{5}{1} = \frac{365}{9} = 40\frac{5}{9}$ $3\frac{1}{2} \times \frac{4}{5} =$ $\frac{7}{2} \times \frac{4}{5} = \frac{28}{10} = 2\frac{8}{10}$ $= 2\frac{4}{5}$
76	<ul style="list-style-type: none"> Multiplication with mixed numbers For problems 1-15 multiplicand is a mixed number and multiplier is a unit fraction For problems 16-30, multiplicand and multiplier are mixed numbers 30 problems 	$9\frac{1}{6} \times \frac{1}{4} =$ $\frac{55}{6} \times \frac{1}{4} = \frac{55}{24} = 2\frac{7}{24}$ $6\frac{1}{9} \times 2\frac{1}{8}$ $\frac{55}{9} \times \frac{17}{8} = \frac{935}{72} = 12\frac{71}{72}$
77	<ul style="list-style-type: none"> Multiplication of mixed numbers Multiplicand and multiplier are mixed numbers 30 problems 	$3\frac{2}{7} \times 6\frac{8}{9} =$ $\frac{23}{7} \times \frac{62}{9} = \frac{1426}{63} = 22\frac{40}{63}$

Lesson	Content Description	Examples
78	<ul style="list-style-type: none"> • Division with fractions • Dividend is a fraction • Divisor is a natural number • 30 problems 	$\frac{2}{7} / 3$ $\frac{2}{7} \times \frac{1}{3} = \frac{2}{21}$ $\frac{4}{5} / 5$ $\frac{4}{5} \times \frac{1}{5} = \frac{4}{25}$
79	<ul style="list-style-type: none"> • Division with fractions • Dividend and divisor are fractions • Divisor is a unit fraction • 30 problems 	$\frac{3}{5} / \frac{1}{7}$ $\frac{3}{5} \times \frac{7}{1} = \frac{21}{5} = 4\frac{1}{5}$ $\frac{1}{2} / \frac{1}{3}$ $\frac{1}{2} \times \frac{3}{1} = \frac{3}{2} = 1\frac{1}{2}$
80	<ul style="list-style-type: none"> • Division with fractions • Dividend and divisor are fractions • 30 problems 	$\frac{3}{7} / \frac{1}{6} =$ $\frac{3}{7} \times \frac{6}{1} = \frac{18}{7} = 2\frac{4}{7}$ $\frac{5}{9} / \frac{4}{9}$ $\frac{5}{9} \times \frac{9}{4} = \frac{45}{36} = 1\frac{9}{36}$ $= 1\frac{1}{4}$
81	<ul style="list-style-type: none"> • Division with fractions and mixed numbers • For problems 1–15, divide a whole number by a fraction • For problems 16–30, divide a whole number by a mixed number • 30 problems 	$6 / \frac{3}{8} =$ $\frac{6}{1} \times \frac{8}{3} = \frac{48}{3} = 16$ $1 / 4\frac{3}{5}$ $\frac{1}{1} \times \frac{5}{23} = \frac{5}{23}$
82	<ul style="list-style-type: none"> • Division of a fraction by a mixed number, or division of a mixed number by a mixed number • Problems 16–30 involve division of a mixed number by a mixed number • 30 problems 	$2\frac{3}{7} / 4\frac{5}{9}$ $\frac{17}{7} \times \frac{9}{41} = \frac{153}{287}$ $\frac{1}{4} / 9\frac{1}{3} =$ $\frac{1}{4} \times \frac{3}{28} = \frac{3}{112}$

FRACTIONS 3 (FRACT3)—Lessons 83–90

Lesson	Content Description	Examples
83	<ul style="list-style-type: none"> • Addition and subtraction of fractions • Common denominators • 1-digit numerators and denominators • Horizontal and vertical format • Student simplifies answer • 30 problems 	$\frac{5}{6} + \frac{5}{6} = \frac{10}{6} = 1\frac{4}{6}$ $= 1\frac{2}{3}$ $\frac{6}{8} - \frac{2}{8} = \frac{4}{8} = \frac{1}{2}$ $\begin{array}{r} \frac{4}{5} \\ + \frac{4}{5} \\ \hline \frac{8}{5} = 1\frac{3}{5} \end{array}$ $\begin{array}{r} \frac{2}{3} \\ - \frac{1}{3} \\ \hline \frac{1}{3} \end{array}$
84	<ul style="list-style-type: none"> • Addition and subtraction of fractions • One denominator is a multiple of the other • Find equivalent fractions; then solve • 1- and 2-digit numerators and denominators • Horizontal and vertical format • Student simplifies answer • 30 problems 	$\frac{6}{7} = \frac{48}{56}$ $+ \frac{35}{56} = \frac{83}{56} = 1\frac{27}{56}$ $\frac{5}{7} - \frac{28}{49} =$ $\frac{35}{49} - \frac{28}{49} = \frac{7}{49}$ $= \frac{1}{7}$
85	<ul style="list-style-type: none"> • Addition of fractions • Denominators are not necessarily multiples of one another • Horizontal and vertical format • Find equivalent fractions; then solve • Student simplifies answer • 30 problems 	$\frac{1}{9} + \frac{3}{8} =$ $\frac{8}{72} + \frac{27}{72} = \frac{35}{72}$ $\frac{4}{7} = \frac{36}{63}$ $+ \frac{4}{9} = \frac{28}{63}$ $\hline \frac{64}{63} = 1\frac{1}{63}$

Lesson	Content Description	Examples
86	<ul style="list-style-type: none"> • Subtraction of fractions • Denominators are not necessarily multiples of each other • Horizontal and vertical format • Find equivalent fractions; then solve • Student simplifies answer • Answer will always be positive • 30 problems 	$\frac{3}{7} - \frac{2}{5} =$ $\frac{15}{35} - \frac{14}{35} = \frac{1}{35}$ $\frac{1}{6} = \frac{4}{24}$ $- \frac{1}{8} = \frac{3}{24}$ <hr/> $\frac{1}{24}$
87	<ul style="list-style-type: none"> • Addition of mixed numbers • Denominators are not necessarily multiples of one another • Horizontal and vertical format • Find common denominator for fractions; then solve • Problems 16-30 will involve an improper fraction that needs to be reduced • 30 problems 	$1\frac{5}{7} + 2\frac{1}{8} =$ $1\frac{40}{56} + 2\frac{7}{56} = 3\frac{47}{56}$ $8\frac{1}{5} = 8\frac{4}{20}$ $+ 8\frac{3}{4} = 8\frac{15}{20}$ <hr/> $16\frac{19}{20}$
88	<ul style="list-style-type: none"> • Subtraction of mixed numbers • Denominators are not necessarily multiples of one another • Horizontal and vertical format • Find common denominator for fractions; then solve • Student simplifies answer • Answer will always be positive • 30 problems 	$3\frac{5}{8} - 1\frac{4}{9} =$ $3\frac{45}{72} - 1\frac{32}{72} = 2\frac{13}{72}$ $8\frac{5}{9} = 8\frac{40}{72}$ $- 7\frac{1}{8} = 7\frac{9}{72}$ <hr/> $1\frac{31}{72}$
89	<ul style="list-style-type: none"> • Subtraction of a fraction from a whole number • Convert whole number to a mixed number with an improper fraction • Horizontal and vertical format • 30 problems 	$9 = 8\frac{6}{6}$ $- \frac{1}{6} = \frac{1}{6}$ <hr/> $8\frac{5}{6}$ $7 - \frac{1}{8}$ $6\frac{8}{8} - \frac{1}{8} = 6\frac{7}{8}$

Lesson	Content Description	Examples
90	<ul style="list-style-type: none"> • Subtraction of mixed numbers • Horizontal format • Find common denominator, regroup to get an improper fraction, and solve • Student simplifies answer • 30 problems 	$9\frac{3}{5} - 2\frac{2}{3} =$ $9\frac{9}{15} - 2\frac{10}{15} = 8\frac{24}{15} - 2\frac{10}{15}$ $= 6\frac{14}{15}$ $4\frac{2}{5} - 1\frac{5}{6} =$ $4\frac{12}{30} - 1\frac{25}{30} = 3\frac{42}{30} - 1\frac{25}{30}$ $= 2\frac{17}{30}$

DECIMALS AND PERCENT 1 (DEC1)—Lessons R1–R5 and 65–69

Lesson	Content Description	Examples
R1	<ul style="list-style-type: none"> • Addition of money • 2-digit addends (cents) • Student provides decimal point and dollar sign with answer • 25 problems 	$\begin{array}{r} \$0.02 \\ + .80 \\ \hline \end{array}$ $\begin{array}{r} \$0.07 \\ + .01 \\ \hline \end{array}$
R2	<ul style="list-style-type: none"> • Addition of money • 3-digit addends (dollars and cents) • Student provides decimal point and dollar sign with answer • 25 problems 	$\begin{array}{r} \$8.85 \\ + 1.32 \\ \hline \end{array}$ $\begin{array}{r} \$7.51 \\ + 4.33 \\ \hline \end{array}$
R3	<ul style="list-style-type: none"> • Subtraction of money • 2-digit minuend (cents) • 2-digit subtrahend (cents) • Student provides decimal point and dollar sign with answer • 25 problems 	$\begin{array}{r} \$0.66 \\ - .37 \\ \hline \end{array}$ $\begin{array}{r} \$0.17 \\ - .12 \\ \hline \end{array}$
R4	<ul style="list-style-type: none"> • Subtraction of money • 3-digit minuend (dollars and cents) • 3-digit subtrahend (dollars and cents) • Student provides decimal point and dollar sign with answer • 25 problems 	$\begin{array}{r} \$8.28 \\ - 6.20 \\ \hline \end{array}$ $\begin{array}{r} \$4.22 \\ - 3.35 \\ \hline \end{array}$
R5	<ul style="list-style-type: none"> • Multiplication with money • 3-digit multiplicand (dollars and cents) • 1-digit multiplier (whole number) • 20 problems 	$\begin{array}{r} \$8.20 \\ \times 2 \\ \hline \end{array}$ $\begin{array}{r} \$2.15 \\ \times 5 \\ \hline \end{array}$

Lesson	Content Description	Examples
65	<ul style="list-style-type: none"> • Addition of decimals • One 1-digit addend (tenths position) • One 2-digit addend (ones and tenths) • 30 problems 	$\begin{array}{r} 2.3 \\ +.2 \\ \hline \end{array}$ $\begin{array}{r} 5.4 \\ +.6 \\ \hline \end{array}$
66	<ul style="list-style-type: none"> • Addition of decimals • Addition in the hundredths, tenths, and ones positions • 2- and 3-digit addends • Some addends omit the hundredths position • 25 problems 	$\begin{array}{r} 7.18 \\ +.25 \\ \hline \end{array}$ $\begin{array}{r} 2.94 \\ +1.52 \\ \hline \end{array}$
67	<ul style="list-style-type: none"> • Subtraction of decimals • 2-digit minuend (tenths and ones position) • 1-digit subtrahend (tenths position) • 30 problems 	$\begin{array}{r} 6.5 \\ -.1 \\ \hline \end{array}$ $\begin{array}{r} 2.2 \\ -.5 \\ \hline \end{array}$
68	<ul style="list-style-type: none"> • Subtraction of decimals • Subtraction in the hundredths, tenths, and ones positions • 2- and 3-digit minuends and subtrahends • Some minuends omit the hundredths position • 25 problems 	$\begin{array}{r} 6.40 \\ -2.95 \\ \hline \end{array}$ $\begin{array}{r} 7.12 \\ -6.44 \\ \hline \end{array}$
69	<ul style="list-style-type: none"> • Writing decimals as fractions and converting fractions with denominators of 10 or 100 to decimals • 25 problems 	$\frac{45}{100} =$ $.8 = \frac{}{10}$

DECIMALS AND PERCENT 2 (DEC2)—Lessons 70–76

Lesson	Content Description	Examples
70	<ul style="list-style-type: none"> Identifying place value Four of eight possible questions generated 15 problems 	IN 4368.9021 WHAT DIGIT IS IN THE: (A) HUNDREDS PLACE? (B) HUNDREDTHS PLACE? (C) THOUSANDS PLACE? (D) TENTHS PLACE?
71	<ul style="list-style-type: none"> Comparing decimals 2-, 3-, or 4-digit numbers 35 problems 	$.853 > .8367$ $.13 < .134$
72	<ul style="list-style-type: none"> Multiplying decimals by first converting decimals to fractions 1-digit multiplicand (whole number) 1-digit multiplier (decimal) 20 problems 	$5 \times .2 =$ $5 \times \underline{\quad} = \underline{\quad} =$ $8 \times .1 =$ $8 \times \underline{\quad} = \underline{\quad} =$
73	<ul style="list-style-type: none"> Multiplying decimals by first converting decimals to fractions 1-digit decimal multiplicand and multiplier 20 problems 	$.5 \times .7 =$ $\underline{\quad} \times \underline{\quad} = \underline{\quad} =$
74	<ul style="list-style-type: none"> Multiplying decimals by first converting decimals to fractions 2-digit decimal multiplicand 1-digit decimal multiplier 20 problems 	$6.1 \times .8 =$ $\underline{\quad} \times \underline{\quad} = \underline{\quad} =$ $.54 \times .5 =$ $\underline{\quad} \times \underline{\quad} = \underline{\quad} =$

Lesson	Content Description	Examples
75	<ul style="list-style-type: none"> • Multiplying decimals • 2- or 3-digit decimal multiplicand (hundredths, tenths, and ones) • 2-digit decimal multiplier (hundredths and tenths) • Student multiplies numbers without decimal points, then adds decimal in correct position • 15 problems 	$9.29 \times 1.5 =$ $\begin{array}{r} 929 \\ \times 15 \\ \hline \end{array}$ $9.29 \times 1.5 =$
76	<ul style="list-style-type: none"> • Converting decimals and fractions to percents • 35 problems 	$.2 = \frac{\quad}{100} = \quad \%$ $.3 = \quad \%$ $\frac{18}{25} = \frac{\quad}{100} = \quad \%$

DECIMALS AND PERCENT 3 (DEC3)—Lessons 77–83

Lesson	Content Description	Examples
77	<ul style="list-style-type: none"> Finding the missing parts of equivalent fractions by multiplying both fractions by the same number Parts of the problem appear step-by-step as other parts are completed 10 problems 	$— \times \frac{2}{6} = \frac{N}{12} \times — >>> \frac{12 \times 2}{6} = \frac{N \times 12}{12}$ $>>> N = \frac{6}{6} >>> N = 4$ $>>> \frac{2}{6} = \frac{2}{12}$
78	<ul style="list-style-type: none"> Finding a percentage of a number by multiplying with fractions Parts of the problem appear step-by-step as other parts are completed 15 problems 	$95\% \text{ OF } 31 = ?$ $>>> \frac{95}{100} = \frac{N}{31} >>>$ $\frac{95}{100} \times 31 = N >>> \frac{95}{100} = \frac{N}{31}$ $95\% \text{ OF } 31 =$
79	<ul style="list-style-type: none"> Finding a percentage of a number by multiplying with decimals Parts of the problem appear step-by-step as earlier parts are completed 15 problems 	$\text{FIND } 98\% \text{ OF } 65$ $>>> \frac{98}{100} = \frac{N}{65} >>> 65 \times \frac{98}{100} = N$ $>>> 65 \times .98 = N >>> 98\% \text{ OF } 65 =$
80	<ul style="list-style-type: none"> Finding an original number by knowing the value of a certain percentage of that number Parts of the problem appear step-by-step as earlier parts are completed 15 problems 	$76.05 \text{ IS } 65\% \text{ OF WHAT NUMBER?}$ $>>> \frac{65}{100} = \frac{76.05}{N} >>> \frac{100}{65} = \frac{N}{76.05}$ $>>> \times \frac{100}{65} = N >>> \frac{7605}{65} = N$ $>>> 76.05 \text{ IS } 65\% \text{ OF}$

Lesson	Content Description	Examples
81	<ul style="list-style-type: none"> Finding what percentage one number is of another number Parts of the problem appear step-by-step as earlier parts are completed 15 problems 	<p>WHAT % OF 48 IS 27.36?</p> $> > > \frac{N}{100} = \frac{27.36}{48} > > > N =$ $\frac{27.36}{48} \times 100$ $> > > N = \frac{2736}{48} > > > N = 57\%$
82	<ul style="list-style-type: none"> (REVIEW) Finding the missing numbers in pairs of equivalent fractions 15 problems 	$\frac{20}{100} = \frac{N}{220} > > > N =$ $\frac{10}{100} = \frac{32}{N} > > > N =$ $\frac{N}{100} = \frac{170}{200}$
83	<ul style="list-style-type: none"> (REVIEW) Solving three kinds of percentage problems 15 problems 	<p>FIND 20% OF 380</p> $\frac{20}{100} = \frac{N}{380}$ <p>256 IS 80% OF WHAT NUMBER?</p> $\frac{80}{100} = \frac{256}{N}$ <p>45% OF WHAT NUMBER IS 63?</p> $\frac{45}{100} = \frac{63}{N}$

DECIMALS AND PERCENT 4 (DEC4)—Lessons 84–90

Lesson	Content Description	Examples
84	<ul style="list-style-type: none"> • Division of decimals • 3-digit dividend (hundredths, tenths, ones) • 1-digit divisor • 20 problems 	$4 \overline{) 9.96}$ $2 \overline{) 8.64}$
85	<ul style="list-style-type: none"> • Division of decimals • 4-digit decimal dividend • 1-digit decimal divisor • Change divisor to whole number before dividing • 15 problems 	$7.272 \div .8 = ?$ DIVISOR = .8 NEW DIVISOR = DIVIDEND = 7.272 NEW DIVIDEND = $8 \overline{) 72.72}$
86	<ul style="list-style-type: none"> • Division of decimals • 4-digit decimal dividend • 2-digit decimal divisor • Change divisor to whole number before dividing • 15 problems 	$2.016 \div 5.6$ DIVISOR = 5.6 NEW DIVISOR = DIVIDEND = 2.016 NEW DIVIDEND = $56 \overline{) 20.16}$
87	<ul style="list-style-type: none"> • Addition of decimals • Student first converts decimals to fractions • Sum fraction is converted to decimal • 2-digit addends (hundredths) • 20 problems 	$.32 + .82 = \frac{\quad}{100} + \frac{\quad}{100}$ $= \frac{\quad}{100} = 1 + \frac{\quad}{100}$ $= \quad \text{(DECIMAL)}$
88	<ul style="list-style-type: none"> • Converting percents to fractions to decimals • 35 problems 	$87\% = \frac{87}{100} = .87$ $26\% = \frac{26}{100} = .26$

Lesson	Content Description	Examples
89	<ul style="list-style-type: none"> Finding values of percentages of whole numbers Percentage may contain a decimal Answer may contain a decimal 20 problems 	$280\% \text{ OF } 69 = ?$ $\times 69 =$ $.2\% \text{ OF } 77 = ?$ $\times 77 =$
90	<ul style="list-style-type: none"> Subtraction of decimals Student converts decimals to fractions, finds difference, then converts answer back to decimal 25 problems 	$1.83 - .19 = \frac{\quad}{100} - \frac{\quad}{100}$ $= \frac{\quad}{100}$ $=$

PRE-ALGEBRA 1 (PREALG1)—Lessons R1-R5 and 65-72

Lesson	Content Description	Examples
R1	<ul style="list-style-type: none"> Ordering of whole numbers Numbers are consecutive by ones when ordered 1-, 2-, or 3-digit numbers 20 problems 	$292 < N < 294$ $19 < N < 21$ $5 < N < 7$
R2	<ul style="list-style-type: none"> Addition equations 1-digit addends 20 problems 	$8 + 8 = N$ $6 + 0 = N$
R3	<ul style="list-style-type: none"> Subtraction equations 1- or 2-digit minuend 1-digit subtrahend 20 problems 	$10 - 6 = N$ $5 - 1 = N$ $1 - 0 = N$
R4	<ul style="list-style-type: none"> Multiplication equations 1-digit multiplicand 1-digit multiplier 20 problems 	$0 \times 8 = N$ $7 \times 3 = N$
R5	<ul style="list-style-type: none"> Division equations 1- or 2-digit dividend 1-digit divisor 20 problems 	$54 / 9 = N$ $6 / 6 = N$
65	<ul style="list-style-type: none"> Addition equations 1-digit addends Missing addend 20 problems 	$N + 1 = 5$ $5 + N = 12$

Lesson	Content Description	Examples
66	<ul style="list-style-type: none"> • Subtraction equations • 1- or 2-digit minuend • 1- or 2-digit subtrahend • Missing minuend or subtrahend • 20 problems 	$N - 4 = 3$ $14 - N = 5$
67	<ul style="list-style-type: none"> • Multiplication equations • 1-digit multiplicand • 1-digit multiplier • Missing multiplicand or multiplier • 20 problems 	$5 \times N = 5$ $N \times 9 = 54$
68	<ul style="list-style-type: none"> • Division equations • 1- or 2-digit dividend • 1-digit divisor • Missing dividend or divisor • 20 problems 	$24 / N = 8$ $N / 7 = 4$
69	<ul style="list-style-type: none"> • Addition equations • 2-digit addend • 2- or 3-digit sum • Missing addend • 20 problems 	$N + 67 = 158$ $14 + N = 45$
70	<ul style="list-style-type: none"> • Subtraction equations • 2- or 3-digit minuend • 2-digit subtrahend • Missing minuend or subtrahend • 20 problems 	$N - 32 = 23$ $113 - N = 34$
71	<ul style="list-style-type: none"> • Multiplication equations • 2-digit multiplicand • 2-digit multiplier • Missing multiplicand or multiplier • 20 problems 	$84 \times N = 5460$ $N \times 18 = 558$

Lesson	Content Description	Examples
72	<ul style="list-style-type: none"> • Division equations • 3- or 4-digit dividend • 2-digit divisor • Missing dividend or divisor • 20 problems 	$2016 / N = 32$ $N / 31 = 92$

PRE-ALGEBRA 2 (PREALG2)—Lessons 73–84

Lesson	Content Description	Examples
73	<ul style="list-style-type: none"> Identify whether one number is $>$, $<$, or $=$ another number Negative numbers 20 problems 	-7 _____ -3 -30 _____ -20
74	<ul style="list-style-type: none"> Addition of two integers 1-digit addends Addends are both positive or both negative 20 problems 	$(-5) + (-6) =$ $3 + 8 =$
75	<ul style="list-style-type: none"> Addition of two integers 1-digit addends One addend is positive and one is negative 20 problems 	$3 + (-6) =$ $(-1) + 8 =$
76	<ul style="list-style-type: none"> Addition of two integers 2-digit addends Addends may be positive or negative; at least one addend is always negative 20 problems 	$(-63) + (-50) =$ $(-92) + 28 =$
77	<ul style="list-style-type: none"> Subtraction with two integers 1-digit minuend 1-digit subtrahend Negative subtrahend 20 problems 	$9 - (-7) =$ $(-2) - (-1) =$
78	<ul style="list-style-type: none"> Subtraction with two integers 2-digit minuend 2-digit subtrahend Negative subtrahend 20 problems 	$71 - (-83) =$ $(-43) - (-20) =$

Lesson	Content Description	Examples
79	<ul style="list-style-type: none"> • Multiplication of two integers • 1-digit multiplicand • 1-digit multiplier • One integer is positive, one is negative • 20 problems 	$(-8) \times 8 =$ $3 \times (-4) =$
80	<ul style="list-style-type: none"> • Multiplication of two integers • 1-digit multiplicand • 1-digit multiplier • Both integers are negative • 20 problems 	$(-2) \times (-4) =$ $(-7) \times (-6) =$
81	<ul style="list-style-type: none"> • Division with two integers • 1- or 2-digit dividend • 1- or 2-digit divisor • Dividend or divisor, or both, are negative • 20 problems 	$(-48) / (-8) =$ $30 / (-6) =$ $(-20) / 5 =$
82	Equations with two fractions <ul style="list-style-type: none"> • Supply the missing number to make fractions equivalent • 20 problems 	$\frac{N}{8} = \frac{21}{24}$ $\frac{N}{3} = \frac{4}{12}$
83	<ul style="list-style-type: none"> • Multiplication of two fractions • Missing multiplicand or multiplier • 20 problems 	$\frac{1}{6} \times \frac{N}{3} = \frac{5}{18}$ $\frac{N}{5} \times \frac{1}{2} = \frac{2}{10}$
84	<ul style="list-style-type: none"> • Division with two fractions • Missing dividend or divisor • Convert problem to multiplication, then supply missing numerator • 20 problems 	$\frac{N}{6} \div \frac{4}{7} = \frac{14}{24}$ $\frac{N}{6} \times \underline{\hspace{1cm}} = \frac{14}{24} \underline{\hspace{1cm}}$ $N = \underline{\hspace{1cm}}$

PRE-ALGEBRA 3 (PREALG3)—Lessons 85–90

Lesson	Content Description	Examples
85	<ul style="list-style-type: none"> Addition and subtraction of fractions with common denominators 1- or 2-digit numerator (less than 4 or greater than 7) 1- or 2-digit denominator (greater than 8 and less than 15) 20 problems 	$\frac{N}{8} - \frac{1}{8} = \frac{1}{8}$ $N =$ $\frac{N}{12} + \frac{4}{12} = \frac{11}{12}$ $N =$
86	<ul style="list-style-type: none"> Addition and subtraction of fractions One denominator is a multiple of the other Student rewrites one fraction to make denominator common, then solves problem 1- or 2-digit numerator 1- or 2-digit denominator 20 problems 	$\frac{N}{56} + \frac{6}{8} = \frac{87}{56}$ $\frac{N}{56} + - = \frac{87}{56}$ $N =$ $\frac{N}{12} + \frac{1}{2} = \frac{13}{12}$ $\frac{N}{12} + - = \frac{13}{12}$ $N =$
87	<ul style="list-style-type: none"> Addition equations Whole numbers, fractions, decimals, and negative numbers Student reduces fraction answers to lowest terms 1-, 2-, 3-, or 4-digit numbers 20 problems 	$N + 738 = 1357$ $N =$ $N + (-522) = -1463$ $N =$ $N + 8.121 = 11.380$ $N =$ $N + \frac{3}{11} = \frac{7}{8}$ $N =$

Lesson	Content Description	Examples
88	<ul style="list-style-type: none"> • Subtraction equations • Whole numbers, fractions, decimals, and negative numbers • Student reduces fraction answers to lowest terms • 1-, 2-, 3-, or 4-digit numbers • 20 problems 	$N - 796 = -741$ $N =$ $N - (-75) = 812$ $N =$ $N - 7.520 = 5.694$ $N =$ $N - \frac{1}{3} = \frac{2}{5}$ $N =$
89	<ul style="list-style-type: none"> • Multiplication equations • Whole numbers, fractions, decimals, and negative numbers • 20 problems 	$N \times 13 = 1131$ $N =$ $N \times (-75) = 3075$ $N =$ $N \times 2.745 = 25.913121$ $N =$ $N \times \frac{6}{7} = \frac{18}{35}$ $N =$
90	<ul style="list-style-type: none"> • Division equations • Whole numbers, fractions, decimals, and negative numbers • 20 problems 	$N \div 33 = 96$ $N =$ $N \div (-32) = (-78)$ $N =$ $N \div \frac{1}{8} = \frac{5}{7}$ $N =$ $N \div 1.674 = 2.562$ $N =$

PLANNING YOUR APPLICATION

PLANNING YOUR APPLICATION

Appropriate Applications

There seems to be an endless variety of ways to use a computer with students. Some that are appropriate for use with the Radio Shack Essential Math Program are:

- A number of computers or “student stations” are placed in a special room or learning lab, where students attend scheduled sessions. A special teacher or teacher aide may be in charge of the lab to help students load and run specified programs, to record scores, and to help with operation of the system. This scheduled approach provides maximum computer utilization and makes possible the lowest obtainable cost per hour of usage.
- Individual computers are placed in regular classrooms, where they are available to the teacher for use with individual students at the teacher’s discretion. This use is becoming more common with the new microcomputers due to the low cost for each system and due to the portability of these systems (no special telephone lines or modems are required).
- Individual computers are loaned or “checked out” to students to take home and use to solve special assignments, or as an incentive for individual studies.
- Computers are provided for general student use in a library — during school, or after hours — for periods of time that a student can reserve in advance.
- Computers are provided for use by teachers at a central service center or audio-visual library. A teacher can check out a system for use in his/her class. Again, the portability of the microcomputer and its freedom from telephone communication lines makes this use convenient.

There are numerous combinations of these and other uses that are possible. Your own unique circumstances — number of students, or number of computers available — will influence your plans. The following information is designed to help you in planning for the use of microcomputers in your school, and to give you the benefit of others’ experience in developing a realistic and satisfactory installation in your own facility.

Saving and Loading Programs: Cassettes vs. Diskettes

The audio cassette is the least expensive method of saving and loading programs for a microcomputer. The basic version of almost all microcomputers includes a cassette recorder for this purpose. Due to its reasonable cost, the cassette recorder merits consideration for use as a program storage device in a classroom; it makes possible the lowest obtainable hardware cost per hour of student operation.

Under proper conditions, the cassette recorder can be a satisfactory storage medium for use with microcomputers. However, there are some special considerations that should be given before deciding on the cassette for program storage over another medium such as the diskette. First, the quality of cassette tapes used for storage of computer programs (digital information) is more critical than for audio use. In addition, static electricity can damage information recorded on cassettes in a carpeted area, or in a dry climate. And, since a program stored on a cassette takes longer to load into a microcomputer than a similar program stored on a diskette, operational considerations may make the use of the cassette recorder for loading programs unrealistic in the classroom setting.

An Alternative: Avoid Frequent Loading of Programs

This is possible with the Radio Shack Essential Math programs, which do not use the one-program-per-lesson approach. The Essential Math Fractions 1 program, for example, contains ten individual lessons. Other programs are similar so that a single program, once loaded, can be used with a large number of students.

This plan has worked very well where it has been tried and is the approach Radio Shack recommends with the Essential Math program.

A Second Alternative: The Radio Shack Network 2 System

This system is a low-cost alternative to cassette tapes for saving and loading student programs for the classroom. The Radio Shack Network Controller allows from one to sixteen TRS-80s to be connected to one TRS-80 disk system using the cassette ports. By using the central disk system, student programs can be saved on disk, and instructional programs can be loaded into the TRS-80 student stations from the central disk system conveniently and reliably. All sixteen student stations can be loaded simultaneously, or any combination of stations can be loaded at a time.

A Third Alternative: A Disk Drive For Each Student Station

Although this increases the cost per student station, this is still considerably less expensive than a conventional timesharing system, and there are several advantages over a cassette. First, several programs can be stored on a single diskette and loaded into the computer conveniently by merely typing the program name to be loaded. In addition, no rewinding or tape positioning using an index counter is required with the diskette. And,

most important, programs can be loaded from a diskette many times faster than from tape, making the diskette much more desirable from an operational standpoint. A program that requires a couple of minutes to load from a cassette can be loaded in a few seconds from a diskette. Finally, remember that a method of loading programs is important when the TRS-80 is used as a medium for instruction with programs such as the Radio Shack Essential Math. However, where the TRS-80 is used as an object of instruction for teaching about the computer, the ability to load and save programs may not be as important. *Introduction to BASIC*, the first part of the Radio Shack Computer Education Series, does not require that any prepared programs be loaded for instruction or demonstration. All program examples are brief and designed to be entered by the student using the keyboard. (One section of this course does teach the proper use of the recorder for saving and loading programs.)

Choosing a Location: Environmental Considerations

Large computer systems require temperature- and humidity-controlled environments with air filtration systems to eliminate dust and other contaminants. Fortunately, the TRS-80 is not so demanding.

At the same time, certain considerations in the location you choose for your micro-computer will have a direct effect upon its operation and reliability. For best results, you should keep these in mind when choosing the location.

Static Electricity

In dry climates and certain seasons, you can walk across a carpet and feel the static discharge when you touch a metal object. Under some climatic conditions, even your clothing can build up this kind of charge, too small for you to feel normally. These static charges can damage magnetically-stored computer data. Larger charges can even wipe out your computer's memory or cause it to appear to "lock up". If you are in a part of the country where humidity is lower than about 40%, be wary! The ideal humidity level for the operation of a computer is 50% or above. The safest bet is to use a non-carpeted room for your computer, and if you find a really stubborn problem, a humidifier should do the trick. An anti-static floor mat at the computer operator's position can also help.

This is a rather infrequent problem in actual practice, so rest assured we are not trying to imply that you will have this or any of the other problems we have mentioned. We are simply explaining why choice of your installation location should be given consideration and what to do just in case you do encounter a problem.

Power Line Interference

Any complex electronic equipment is sensitive to power line conditions affecting the voltage and current coming out of your wall socket. Computers are probably more sensitive than other electronics because the loss of even one bit (one tiny electrical charge) of information can cause a problem to “bomb out” or a data file to be lost. This is rarely a problem unless you are operating in an environment where heavy electrical machinery is in operation. Yet you might experience trouble if an appliance or office machine has a defective switch which arcs when turned on or off. If this happens, you will have to (1) repair the appliance, or isolate the power going to the computer by either (2) installing a separate line or (3) using a line filter. (Radio Shack sells a low-cost line filter that will cure the problem in 90% of these cases.) In a severe case, both (2) and (3) may be required. “Brownouts” (periodic drops in line voltage to unusually low levels) or power line “spikes” (transient surges of very large voltage levels lasting only a fraction of a second) may require the addition to your system of a “constant voltage transformer.”

Power line problems are rare and many times can be solved before they occur by proper choice of installation location for your computer system. The more complex the system, the more consideration you should give to your installation.

**MAKING A BACKUP COPY
OF THE ESSENTIAL MATH PROGRAM**

MAKING A BACKUP COPY OF ESSENTIAL MATH TAPES

It is good practice to make a backup copy of Essential Math program cassettes to use with your students. The original cassettes supplied with the program should be stored to protect them from damage. To make a backup copy, follow the steps below.

I. GETTING READY

A. If the computer is off:

1. Follow Step 1 on page 10 of this manual.
2. Skip to II.

B. If the computer is on and an Essential Math program is loaded:

1. If the program is running, use the termination code **SHIFT** **S** and wait for the **READY** prompt.
2. When the **READY** prompt is showing, skip to III.

C. If the computer is on and a program other than an Essential Math program is loaded:

1. If the program is running, terminate the program by using the **BREAK** key or any special code that may apply to that particular program.
2. When the **READY** prompt appears, type **N** **E** **W** **ENTER**.
3. When the **READY** prompt appears again, you are ready to load an Essential Math program.

II. LOADING AN ESSENTIAL MATH PROGRAM

Follow Steps 2 through 8 on page 10 of this manual.

III. MAKING A NEW COPY OF THE PROGRAM TAPE

- A. Place a blank cassette in the recorder. (Use only TRS-80 C-20 certified cassettes, or other digital quality cassettes.)
- B. Make sure the tape is rewound. Use the "FAST FORWARD" button if necessary to advance the tape past the leader.
- C. Press "PLAY" and "RECORD" simultaneously.

- D. Type **C S A V E " C "** and press **ENTER**.
- E. Wait for the **READY** prompt to reappear. (The recorder will start to run and will stop automatically when the prompt appears.)
- F. Rewind the cassette.
- G. Remove and label the cassette which now contains a new copy of an Essential Math program.

MAKING A BACKUP COPY OF ESSENTIAL MATH DISKETTES

It is good practice to make a backup copy of each Essential Math program diskette to use with your students. The original diskettes supplied with the program should be stored to protect them from damage. To make a backup copy, follow the steps below.

I. Model I Two-Drive System

1. Turn on everything except the TRS-80 keyboard. If this is the first time you've ever used the Radio Shack Disk System, refer to the *Disk Operating System/Disk Basic* manual for detailed instructions.
2. Insert a new, blank diskette in DRIVE 1 (second from the expansion interface on the cable) with the square notch up and the label to the right, and close the door.
3. Place an adhesive tab (provided with new diskettes) over the square notch in the Essential Math program diskette. If you do not have any tabs, use a small piece of cellophane tape.
4. Insert the program diskette in DRIVE 0 (closest to the expansion interface on the cable) with the covered notch up and the label to the right, and close the door.
5. Turn on the TRS-80 keyboard. (The On/Off button is on the right rear of the keyboard.)

6. When the screen shows:

You type:

DOS READY

B A C K U P **ENTER**

SOURCE DRIVE NUMBER?

0 **ENTER**

DESTINATION DRIVE NUMBER?

1 **ENTER**

BACKUP DATE (MM/DD/YY)?

0 9 / 0 1 / 8 2 **ENTER**

(Example for September 1, 1982)

The drives will come on and the computer will proceed to make the backup. If, after the drives stop spinning, the screen shows:

BACKUP COMPLETE

HIT <ENTER> TO CONTINUE

then press **ENTER**.

If, after the drives stop spinning, the screen shows an error message of any kind, or does not say **BACKUP COMPLETE**, then press the RESET button and

go back to Step 6. If an error still occurs, then get a new blank diskette or bulk erase the diskette you have been using as destination disk. Then insert the blank diskette in DRIVE 1, press **ENTER**, and go to Step 6.

II. Model I One-Drive System

1. Turn on everything except the TRS-80 keyboard. If this is the first time you've ever used the Radio Shack Disk System, refer to the *Disk Operating System/Disk Basic* manual for detailed instructions.
2. Place an adhesive tab (provided with new diskettes) over the square notch in the Essential Math program diskette. If you do not have any tabs, use a small piece of cellophane tape.
3. Insert the program diskette in the disk drive with the covered notch up and the label to the right. Close the door.
4. Turn on the TRS-80 keyboard. (The On/Off button is on the right rear of the keyboard.)

5. When the screen shows:

You type:

DOS READY

B A C K U P ENTER

SOURCE DRIVE NUMBER?

0 ENTER

DESTINATION DRIVE NUMBER?

0 ENTER

BACKUP DATE (MM/DD/YY)?

0 9 / 0 1 / 8 2 ENTER

(Example for September 1, 1982)

INSERT SOURCE DISK

Press **ENTER**

INSERT DESTINATION DISK

After the red light on the disk drive goes off, remove the program diskette and insert a new, blank diskette with the uncovered square notch up and the label to the right. Close the door and press **ENTER**.

INSERT SOURCE DISK

Continue to switch back and forth between the program diskette (**SOURCE DISK**, notch covered) and the new diskette (**DESTINATION DISK**, notch uncovered) as instructed on the screen. Do not open the disk drive door while the red light is on.

If the screen shows:

BACKUP COMPLETE
HIT <ENTER> TO CONTINUE

then press **ENTER**.

If the screen shows an error message of any kind, or does not say **BACKUP COMPLETE**, then put the program diskette back in the drive, press the **RESET** button, and go back to Step 5. If an error still occurs, then get a new blank diskette or bulk erase the diskette you have been using as destination disk. Put the program diskette back in the drive, press **ENTER**, and go to Step 5.

III. Model III Two-Drive System

1. Turn on the computer. (The On/Off switch is under the right side of the keyboard.)
2. Insert a new, blank diskette in DRIVE 1 (the top disk drive) with the square notch to the left and the label facing up, and close the door.
3. Place an adhesive tab (provided with new diskettes) over the square notch in the Essential Math program diskette. If you do not have any tabs, use a small piece of cellophane tape.
4. Insert the program diskette in DRIVE 0 (the bottom drive) with the covered notch to the left and the label facing up, and close the door.
5. Press the orange **RESET** button.

6. When the screen shows:

You type:

Enter Date (MM/DD/YY)?

0 9 / 0 1 / 8 2 ENTER

(Example for September 1, 1982)

Enter Time (HH:MM:SS)?

Press **ENTER**

TRSDOS Ready

B A C K U P ENTER

SOURCE Drive Number?

0 ENTER

DESTINATION Drive Number?

1 ENTER

SOURCE Disk Master Password?

P A S S W O R D ENTER

The drives will come on and the computer will proceed to make the backup. If, after the drives stop spinning, the screen shows:

****Backup Complete****

then remove the original Essential Math diskette from DRIVE 0 and store it in a safe place. You can now place your backup copy in DRIVE 0 and continue working with the program.

If, after the drives stop spinning, the screen shows an error message of any kind, or does not say **Backup Complete**, then press the orange RESET button and go back to Step 6. If an error still occurs, then get a new blank diskette or bulk erase the diskette you have been using as destination disk. Then insert the blank diskette in DRIVE 1, press the RESET button, and go to Step 6.

IV. Model III One-Drive System

1. Turn on the computer. (The On/Off switch is under the right side of the keyboard).
2. Place an adhesive tab (provided with new diskettes) over the square notch in the Essential Math program diskette. If you do not have any tabs, use a small piece of cellophane tape.
3. Insert the program diskette in the disk drive with the covered notch to the left and the label facing up. Close the door.
4. Press the orange RESET button.

5. When the screen shows:

You type:

Enter Date (MM/DD/YY)?

0 9 / 0 1 / 8 2 ENTER

(Example for September 1, 1982)

Enter Time (HH:MM:SS)?

Press **ENTER**

TRSDOS Ready

B A C K U P ENTER

SOURCE Drive Number?

0 ENTER

DESTINATION Drive Number?

0 ENTER

SOURCE Disk Master Password?

P A S S W O R D ENTER

**Insert SOURCE Diskette
<ENTER>**

Press **ENTER**

**Insert DESTINATION Diskette
<ENTER>**

After the red light goes off, remove the program diskette and insert a new, blank diskette with the uncovered notch to the left and the label facing up. Close the door and press **ENTER**.

Insert SOURCE Diskette
<ENTER>

Continue to switch back and forth between the program diskette (**SOURCE diskette**, notch covered) and the new diskette (**DESTINATION diskette**, notch uncovered) as instructed on the screen. Do not open the disk drive door while the red light is on.

If the screen shows:

****Backup Complete****
Insert SYSTEM Diskette <ENTER>

then press **ENTER**.

If the screen shows an error message of any kind, or does not say **Backup Complete**, then put the program diskette back in the drive, press the RESET button, and go back to Step 5. If an error still occurs, get a new blank diskette or bulk erase the diskette you have been using as destination diskette. Put the program diskette back in the drive, press the RESET button, and go to Step 5.

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NOTE: Good data processing procedure dictates that the user test the program, run and test sample sets of data, and run the system in parallel with the system previously in use for a period of time adequate to insure that results of operation of the computer or program are satisfactory.

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